

Ser. 2

V. A

1888

1888

LIBRARY
KENTUCKY GEOLOGICAL SURVEY

ALL
STATE
LIBRARY

GEOLOGICAL SURVEY OF KENTUCKY.

JNO. R. PROCTER, DIRECTOR.

CHEMICAL REPORT OF THE COALS. SOILS. CLAYS, PETROLEUM, MINERAL WATERS ETC., ETC., OF KENTUCKY.

BY ROBERT PETER, M. D., ETC., ETC.,

CHEMIST TO THE SURVEY,

ASSISTED BY ALFRED M. PETER, S. M.

THE SEVENTH CHEMICAL REPORT IN THE NEW SERIES, AND THE ELEVENTH SINCE
THE BEGINNING OF THE SURVEY.

VOL. A PART III.

STEREOTYPED FOR THE SURVEY BY JOHN D. WOODS, PUBLIC PRINTER, FRANKFORT, KY.

GEOLOGICAL SURVEY OF KENTUCKY.

JNO. R. PROCTER, DIRECTOR.

CHEMICAL REPORT OF THE COALS. SOILS. CLAYS, PETROLEUM, MINERAL WATERS ETC., ETC., OF KENTUCKY.

BY ROBERT PETER, M. D., ETC., ETC.,
CHEMIST TO THE SURVEY,

ASSISTED BY ALFRED M. PETER, S. M.

THE SEVENTH CHEMICAL REPORT IN THE NEW SERIES, AND THE ELEVENTH SINCE
THE BEGINNING OF THE SURVEY.

VOL. A PART III.

STEREOTYPED FOR THE SURVEY BY JOHN D. WOODS, PUBLIC PRINTER, FRANKFORT, KY.

INTRODUCTORY LETTER.

CHEMICAL LABORATORY,
KENTUCKY GEOLOGICAL SURVEY,
LEXINGTON, KY., April 17, 1888.

JNO. R. PROCTER, Esq.,

Director of Geological Survey of Kentucky:

DEAR SIR: I have the pleasure herewith to send you for publication, my report of the chemical work done in this Laboratory for the Geological Survey since the publication of my last report.

Very respectfully,

ROBERT PETER, M. D., ETC.,
Chemist to Kentucky Geological Survey.

CHEMICAL REPORT.

Of the more than 273 analyses reported in the following pages, 137 are of coals from 14 counties in the eastern coal field of Kentucky; the greater number of them being from Bell, Breathitt, Clay, Harlan, Leslie, Perry and Whitley counties; a comparatively few samples are from Johnson, Knott, Knox, Letcher, Laurel and Martin counties. In the Appendix, West Virginia is represented in the analyses of seven samples, for comparison with Kentucky coals, together with the analyses of many other coals received since this report was made.

Most of these coals would come under the head of semi-bituminous, splint, or block coal; some few are, no doubt, entitled to the name "bituminous coal," and some of them are cannel coals. With them are reported some with such high ash percentage as to cause them to be classed with the bituminous shales. These, however, are comparatively few in number, and most of them could be used for fuel in their immediate vicinity. Generally speaking, these coals are of very good quality, and many of them would answer admirably for the manufacture of coke, while some of the splint or block coals could, probably, be used without coking for smelting iron ores. In short, the coals of this, one of the two immense coal fields of Kentucky, will generally compare favorably with those of any other region in the world.

Comparing the ash percentages of the coals of the seven counties which furnished the greatest number of samples, we find the following results, viz.

COUNTIES.	No. of samples analyzed.	Highest ash percentage.	Lowest ash percentage.	Average ash of the whole.	Average exclusive of highest ash percentage.
Whitley . .	18	7.90	1.54	3.56	none excluded.
Bell . . .	11	8.40	1.80	4.28	none excluded.
Harlan . .	44	47.48	2.20	7.76	5.12 excluding 4 highest.
Leslie . .	11	16.00	4.00	8.19	7.40 excluding 1 highest.
Breathitt .	10	24.20	5.28	9.32	8.08 excluding 1 highest.
Clay . . .	9	32.00	5.80	9.79	7.00 excluding 1 highest.
Perry . . .	13	16.80	2.56	9.88	8.48 excluding 1 highest.

Of course such a comparison as this, of a limited number of samples, might not apply to the products of the whole of the several counties in question, as other samples from coal beds not here represented might alter these averages materially, and it is proper to state that those coals or bituminous shales which give very large ash, should be excluded from such calculations. Moreover, it is generally found that cannel coals—which variety abounds in Breathitt county particularly—very generally give more ash than the softer coals.

The West Virginia coals gave the following results, viz.: The 7 samples gave—highest ash, 12.76 per cent.; the lowest, 2.40 per cent.; the general average of their ash, 4.94 per cent.

In all these coals the sulphur ranges from 6.042 per cent. in what is really bituminous shale, of Clay county; 5.436 in this kind of shale from Harlan county, and 5.078 in cannel coal of Bell county, down to 0.420 in Harlan county coal, and 0.418 per cent. in coal of West Virginia. Generally the percentage of sulphur is comparatively moderate or small in these coals.

The thirty-nine *Cokes* analyzed were principally from Bell, Harlan and Knox counties, there being but one sample each from Laurel, Letcher and Whitley counties. West Virginia furnished 8 samples.

The 20 samples of coke from Bell county gave an average ash percentage of 7.83, but without the highest four, which would be excluded from this manufacture, the ash was only 6.97 per cent., the highest being 12.2 and lowest only 4.00; which compares favorably with the best cokes in the market. The percentage of carbon in the coke varied from 95.80 in F. Barner's to 85.30 in Jas. Meyers'.

The average ash of the 4 Harlan county cokes was 9.10 per cent. But excluding the highest, 17.9, the ash average is only 6.20 per cent. The 4 Knox county cokes gave an average of 5.20 per cent. of ash, including the highest, 8.40. The lowest being only 3.20. The 8 West Virginia cokes gave a general average of 6.47 per cent. of ash, including one at 9.10 per cent.

The sulphur is moderate or small in all these cokes which do not contain too much ash, ranging from 1.975 to 0.217 per cent.

Of the 51 soils, the analyses of which are herewith reported, 12 are from Ballard county; 15 from Calloway; 2 from Graves; 11 from Marshall, and 10 from McCracken; in all, 50 from the so-called Jackson Purchase; one only is from Jefferson county. Five other soils, from Clinton county, are reported in the Appendix.

The Jackson Purchase soils and subsoils, with the exception of those from the bottom lands of the Ohio, Obion and Tennessee rivers and Shannon creek, and the Oak and Hickory Flats, all contain but a small or moderate proportion of organic matters or humus. This is, probably, due to the circumstance that they, with the exceptions above noted, generally contain quite a large quantity of sand and insoluble silicates in proportion to their alumina. The exceptional soil, No. 2622, from the first bottom of Tennessee river, Calloway county, gave but 77.719 per cent. of siliceous residue; while the red sandy soil of Sandy Ridge, No. 2565, gave 93.385 per cent., the general range being from about 81. to 91. per cent.

This rather large proportion of sand, although it is very fine sand generally, and moderate proportion of alumina, cause these soils to be light and porous, easily worked or drained under favorable conditions.

Lime and phosphoric acid are small, or only moderate in quantity, in several of them, which may render necessary the use of calcareous and phosphatic fertilizers, but the potash is usually in good proportions; a few exceptions only being noticeable. This fact, as well as their light porous condition, allowing free penetration of the atmospheric agencies, with the absence of gravel or coarse sand, aids in making these soils favorable to tobacco culture.

All of the 26 clays, etc., reported, are from the Jackson Purchase. Six from Ballard county; 8 from Calloway; 5 from Graves; 1 from Hickman; 6 from Marshall, and 5 from McCracken county; mostly from the Tertiary and Quaternary formations. A few of the most siliceous or sandy of them are derived from decomposing chert or hornstone of the Lower Carboniferous siliceous group.

Many of them are highly refractory, and would make good fire-brick or furnace linings, or, possibly, glass pots. Some

CHEMICAL REPORT.

are white enough for fine pottery-ware. Some, composed mainly of very fine sandy material, would answer to mix with tough clays, or probably for glazing material or glass, or for the manufacture of water cement. Several of these siliceous clays have such a fine texture that they may be used as scouring or polishing material.

Some of them, containing much iron peroxide, may find their applications as cheap paints, for terra-cotta work or cheap pottery-ware.

The 3 iron ores from Bath county belong to the Clinton group, and present the general characteristics of the so-called Clinton Iron Ore.

BALLARD COUNTY.

MINERAL WATERS.

No. 2554—MINERAL WATER, *from the Kilgore Spring at Blandville: temperature (in August) 58° F. Slightly chalybeate.* Collected by R. H. Loughridge, August 19th, 1885. Sample in stone-ware gallon jug. Cork sealed.

Evaporated to dryness, it left 0.0674 per 1000 of saline matters, which lost 0.0030 of organic matter on ignition.

The saline matters consisted of chlorides, carbonates and sulphates of calcium, magnesium, potassium, sodium and iron, silica and a trace of Lithium. They are slightly alkaline in reaction.

The water is a good saline chalybeate.

No. 2555—MINERAL WATER, *from the McGee Spring, Blandville. Strongly chalybeate. Temperature 60° F. (in August).* Collected by R. H. Loughridge, August, 1885.

COMPOSITION IN 1,000 PARTS.

Carbonate of iron	0.0244
Carbonate of lime . . . . .	.0108
Carbonate of magnesia . . . . .	.0019
Chloride of magnesium . . . . .	.0099
Chloride of sodium . . . . .	.0053
Carbonate of soda . . . . .	.0316
Sulphate of potash . . . . .	.0072
Silica . . . . .	.0156
Total solid matters	0.1067

CHEMICAL REPORT.

It contains also traces of organic matters and ammonia. It appears to be a good alkaline saline chalybeate water.

BALLARD COUNTY.

SOILS AND SUBSOILS.

No. 2556—SOIL. *Crawfishy, on west fork of Mayfield creek, taken to the depth of 10 inches, near the bridge on the road from Blandville to Milburn.* Collected by R. H. Loughridge, 1884.

The dried soil contained small friable clods, is of a buff-grey color. The coarse sieve* removed only a few small fragments of stone. Its siliceous residue, after digestion in acids, all passed through the fine sieve,† except 16.5 per cent. of fine white quartz sand.

No. 2557—VIRGIN SOIL. *Ohio river bottom. Taken 8 inches deep from Clear Lake Ridge, elevated a few feet above the cypress swamps, and having a growth of white oak, hickory, gum, prickley ash, walnut and black locust. Undergrowth of cane.* Four miles west of Barlow. Geological formation: Quaternary brown loam table lands. Collected by R. H. Loughridge, 1884.

Dried soil in small friable clods of a dark grey-brown color. All passed through the coarse sieve, except a small quantity of vegetable debris. Its siliceous residue, from digestion in acids, all passed through the fine sieve, except a small quantity of fine white sand.

No. 2558—VIRGIN SOIL. *Obion bottom. South of Arlington. Taken to the depth of 10 inches.* Collected by R. H. Loughridge, 1884.

Dried soil in friable clods of a dark grey-brown color. All passed through the coarse sieve except a little vegetable debris. Its siliceous residue all passed through the fine sieve.

No. 2559—VIRGIN UPLAND SOIL. *Brown loam from the Barrens or tobacco lands, one mile south-east of Hazlewood post-office. Taken to the depth of 10 inches. Timber: red*

* With 64 meshes to the centimeter square.

† With 1600 meshes to the centimeter square.

and black-jack oaks. Geological formation: Quaternary brown loam table lands. Collected by R. H. Loughridge, 1884.

Dried soil contains friable clods of a grey-brown color. All passed through the coarse sieve except a very small quantity of small shot-iron ore. Its silicious residue all passed through the fine sieve.

No. 2560—SUBSOIL of the next preceding, taken to depth of 6 to 14 inches below the surface. Collected by R. H. Loughridge, 1884.

Dried subsoil in friable clods of a brownish-buff color. All passed through the coarse sieve except a few particles of shot-iron ore. Its silicious residue all passed through the fine sieve.

No. 2561—VIRGIN SOIL. Flatwood loam soil. Bandana post-office. Taken to the depth of 10 inches. Timber: red, post and white oaks, with some hickory, gum, persimmons, sycamore and hazel brush. Collected by R. H. Loughridge, February 25th, 1884.

Dried soil with friable clods of a light-yellowish umber color. The coarse sieve separated from it some little shot-iron ore and a few small quartz pebbles. All its silicious residue passed through the fine sieve.

No. 2562—SUBSOIL of the next preceding, taken at from 10 to 14 inches below the surface. Collected by R. H. Loughridge.

The dried subsoil is in moderately firm clods of a yellowish-grey color. All passed through the coarse sieve except very few particles of shot-iron ore. Its silicious residue all passed through the fine sieve.

No. 2563—VIRGIN SOIL. Dark loam from Barlow. Taken to the depth of 8 inches. Timber: white oak, poplar, gum and sassafras. Geological formation: Quaternary brown loam lands. Collected by R. H. Loughridge.

The dried soil mostly in powder with some small friable clods of a brownish-umber color. All passed through the coarse sieve except a little shot-iron ore. Its silicious residue all passed through the fine sieve.

No. 2564—SUBSOIL of the next preceding, taken from 8 to 10 inches below the surface. Collected by R. H. Loughridge.

The dried subsoil is in pretty firm small clods, of a dirty yellowish color. The coarse sieve removed from it only a little vegetable debris. All its silicious residue passed through the fine sieve.

No 2565—RED SANDY SOIL of Sandy Ridge, 3 miles west of Ogden's store. Sample taken 10 inches deep. Timber: chiefly red oaks. Collected by R. H. Loughridge.

Dried soil of a light snuff-brown color. No clods. All passed through the coarse sieve except a small quantity of shot-iron ore. The fine sieve removed from it 44.65 per cent. of fine sand in rounded grains.

No. 2566—VIRGIN DARK, BLUFF LOAM SOIL, near mouth of Mayfield creek, at Steam Shovel. Taken 8 inches deep. Growth: poplar, white oak and hickory. Collected by R. H. Loughridge.

Dried soil of a grey-brown color, containing but a few friable clods. Its silicious residue all passed through the fine sieve.

No. 2567—SUBSOIL of the next preceding bluff loam, taken from 8 to 12 inches below the surface.

The dried subsoil, of a brownish-buff color, is mostly in the form of small friable clods. All passed through the coarse sieve except a little vegetable debris. Silicious residue all passed through the fine sieve.

Calculated Dried at 212° F.

CHEMICAL REPORT.

NUMBER IN REPORT.	2556	2557	2558	2559	2560	2561	2562	2563	2564	2565	2566	2567
Organic and volatile matters	5.772	4.635	3.096	2.079	3.642	2.114	3.510	2.364	1.961	3.733	1.281	
Alumina and manganese oxide	2.945	6.876	4.217	3.065	4.613	4.639	4.523	3.906	4.602	2.130	3.268	
Iron peroxide	4.124	1.860	1.915	1.907	2.478	2.363	3.077	2.112	2.870	1.403	1.519	2.224
Lime carbonate	1.196	.210	1.463	.096	.071	.071	.046	.146	.086	.071	.349	.146
Magnesia	.181	.273	.267	.134	.205	.198	.344	.289	.222	.124	.175	.234
Phosphoric acid (P_2O_5)	.008	.226	.138	.062	.052	.103	.115	.100	.126	.094	.095	.078
Potash extracted by acids	.477	.723	.504	.420	.836	.295	.422	.419	.674	.250	.265	.109
Soda extracted by acids	.389	.145	not est.	not est.	.248	.136	.260	not est.	.236	.057	.023	
Water expelled at 380-400°	.556	1.263	.941	.571	.425	.648	1.038	.698	.553	.1.604	.958	
Sand and insoluble silicates	90.616	80.999	86.856	90.636	90.219	87.952	88.866	88.394	88.766	93.385	90.303	91.067
Totals	100.534	100.611	100.931	100.047	100.975	100.353	100.291	100.174	100.408	99.984	100.230	99.388
Hygroscopic moisture	1.100	2.290	1.625	1.175	1.180	1.430	1.375	1.300	1.235	0.600	1.300	0.900
Potash in silicious residue	1.497	1.069	1.435	1.476	1.229	1.439	1.591	1.415	1.389	.997	1.859	2.031
Soda in silicious residue	.834	.277	1.243	not est.	1.032	1.208	1.551	.257	not est.	.567	1.025	.927
Sand	16.500	not est.	not est.	not est.	not est.	not est.	not est.	not est.	not est.	44.650	not est.	not est.

CHEMICAL REPORT.

The virgin soil, No. 2557, of the Ohio river bottom, is the richest in essential elements of fertility of all these soils, and ought to be very productive under good culture, provided it is well drained. Its proportion of available potash, 0.773 per cent., is extraordinary. It is exceeded in this particular, however, by No. 2560, which has 0.836 per cent. All of these soils contain more than the usual average of potash, except this subsoil, No. 2567, which has only 0.109 per cent., which, other conditions being favorable, fits them for the cultivation of tobacco, hay or other green crops. Nos. 2559-60-1-2-4-5, are more or less deficient in lime, and Nos. 2556-9-60-5-6-7, also contain too little phosphoric acid, and would be benefited by top dressings of lime and of commercial phosphatic fertilizers. No. 2556 is especially deficient in phosphoric acid, while it contains the other essential elements in good or large proportions. It would require only phosphatic manures, such as ground-bone, superphosphate, guano, etc., to make it quite productive; provided drainage and other physical conditions are present. All of these soils are of fine texture; none contain coarse sand or gravel. They all have potash in more than average proportions, except No. 2567, which, indeed, contains what is generally considered a fair average quantity.

CLAYS OF BALLARD COUNTY.

No. 2568—*SANDY CLAY. Tertiary. Half a mile north-west of Blandville.* Collected by Jno. R. Procter.

Nearly white. Quite plastic. Contains no appreciable coarse sand. Infusible before the blow-pipe. Calcines white.

No. 2569—*CLAY. Three miles east of Blandville. A nearly white clay.* Collected by R. H. Loughridge.

Quite plastic. Contains no coarse sand. Of very difficult fusion before blow-pipe. Calcines white.

No. 2570—*CLAY. North side of west fork of Mayfield creek, 4 miles north-east of Milburn.* Collected by R. H. Loughridge.

Of a very light buff-grey color. Quite plastic. Contains no coarse sand. Infusible before the blow-pipe. Calcines light-grey.

No. 2571—CLAY. *Two miles north of Wickliffe.* Collected by R. H. Loughridge.

Nearly white. Contains much fine white opaque sand. Quite plastic. Infusible before the blow-pipe. Calcines white.

No. 2572—YELLOW OCHREOUS CLAY. *Wickliffe, Ballard county.* Collected by R. H. Loughridge.

Of a handsome yellow ochre color. Washed in water it left a very small proportion of very fine sand. Before the blow-pipe it fuses into a blackish slag or glass. Calcines of a handsome red color.

No. 2573—FIRE-CLAY. *Wickliffe, Ballard county.* Collected by R. H. Loughridge.

Of a dark-grey color when dried. Contains fine sand, brownish, mixed with a few small specks of mica. Before the blow-pipe, of very difficult fusion. Calcines white.

COMPOSITION OF THESE BALLARD COUNTY CLAYS.

Air Dried.

NUMBER IN REPORT.	2568	2569	2570	2571	2572	2573
Silica	74.840	71.180	76.540	63.840	44.840	73.240
Alumina	16.580	20.800	14.820	26.040	22.830	15.760
Iron peroxide	1.400	1.780	.960	.740	20.350	1.920
Lime . . . .	.269	trace.	trace.	trace.	.101	.325
Magnesia . . . .	.209	.101	.331	.137	.138	.519
Potash	1.293	.247	.926	.714	not est.	1.467
Soda . . . .	.283	.291	.229	.207	not est.	.147
Water, etc. . . .	5.126	5.601	6.194	8.322	11.741	6.622
Totals	100.000	100.000	100.000	100.000	100.000	100.000
Sand	not est.	not est.	not est.	44.000	not est.	53.490

All of these Ballard county clays are quite refractory except the ochreous clays or yellow ochre, and could be used as fire-clay in its various applications. They all contain considerable proportions of fine sand. Some of them, having similar composition with the celebrated German glass pot clays,

deserve a trial for this use. The ochreous clay, No. 2572, could be used, after washing to remove sand, as a cheap pigment, either in its natural condition or after calcination.

No. 2574—GREEN SAND. *Bluff at Caledonia opposite to Ballard county.* *Tertiary.* Collected by R. H. Loughridge.

A dark-colored, nearly black, friable material. Powder of dark greenish-grey color.

COMPOSITION. (Air Dried.)

Silica	59.940
Alumina	13.870
Iron peroxide	10.210
Lime . . . . .	.549
Magnesia	2.010
Potash	3.243
Soda . . . . .	.078
Phosphoric acid	a trace.
Water	10.600
	100.000

This contains less potash than is usually found in Glauconite (green sand), but it has, probably, been somewhat altered by weathering.

BATH COUNTY.

IRON ORES.

No. 2575—IRON ORE from *Carnel Rice's, property of Captain W. G. Allen.* *Clinton group of Upper Silurian formation.*

Collected by W. M. Linney, June, 1885.

Ore of a yellowish-brown color of the usual structure of the Clinton iron ore.

No. 2576—IRON ORE from the *Purvis lands in Bath county.*

Clinton group. Collected by W. M. Linney, June, 1885.

Resembles the preceding, but is reddish in color.

No. 2577—IRON ORE. *Average sample from the lands of Wm. Warren, near head of Rose Run, Bath county. Clinton Group.* Collected by W. M. Linney, June 1st, 1885.

Ore of the structure of Clinton ore, of a reddish-brown color.

COMPOSITION OF THESE BATH COUNTY CLINTON IRON ORES.
(Air Dried.)

Number in Report.	2575	2576	2577
Iron peroxide	47.630	51.430	58.570
Alumina	5.468	5.132	3.720
Lime carbonate	16.560	13.080	15.160
Magnesia carbonate	9.974	9.444	4.528
Phosphoric acid (P_2O_5)	1.202	1.138	1.010
Silica	7.180	7.800	6.960
Water, expelled at $212^{\circ} F.$	1.143	.693	1.607
Carbonic acid, water, etc.	10.863	11.283	8.445
Totals	100.000	100.000	100.000
Percentage of iron	33.341	36.001	40.999

Although the iron in the analysis is estimated as peroxide, some of it, in all these ores, is in the form of ferrous carbonate. They also contain a little organic matter not estimated.

These ores have considerable proportions of lime and magnesia, which will aid in fluxing them, and a notable quantity of phosphoric acid, which will not prevent their profitable use in the production of merchantable iron.

BELL COUNTY.

COALS.

No. 2578—COAL. *Browning's cannel coal.* Three miles above Pineville, on Cumberland river; 275 feet above drainage. Collected by R. C. B. Thruston. A 23-inch layer.

A pure-looking cannel coal. Fracture large, irregular conchoidal. Bird's-eye fracture in parts. Some shining pyrites, but no fibrous coal apparent.

No. 2579—COAL. *Myers' bank.* Low Branch of Yellow creek. Collected by R. C. B. Thruston. Sample from the 12-inch, 16-inch and 15-inch layers of the bed.

Generally pitch-black, breaking irregularly cuboidal with shining surfaces. Some fibrous coal and pyrites in some of the pieces.

No. 2580—COAL. *Caney Branch of Yellow creek.* Collected by R. C. B. Thruston. Sample from the 20-inch and 8-inch layers of the bed.

Generally pitch-black, breaking irregularly, partly cuboidal, with shining surfaces. No fibrous coal or pyrites apparent in the sample.

No. 2581—COAL. *James Barnett's.* Clear Fork of Yellow creek of Cumberland river. Average sample of the coal tested for coking. Collected by R. C. B. Thruston.

A pure-looking sample, generally of what seems to be bituminous, with some little splint-coal.

No. 2582—COAL. *F. R. Barner's.* Yellow creek. Average sample from the barrel-full tested for coking. Collected by R. C. B. Thruston.

No. 2583—COAL. *Myers'.* Yellow creek. Average sample from the barrel-full tested for coking. Collected by R. C. B. Thruston.

No. 2584—COAL. *Alf. McTee's.* Yellow creek of Cumberland river. Average sample from the coal tested for coking. Collected by R. C. B. Thruston.

No. 2585—COAL. *Dean seam; lower 36 inches of the bed.* Greasy creek of Cumberland river. Average sample of the coal collected for coking by R. C. B. Thruston.

No. 2586—COAL. *Dean's seam.* Average sample collected for coking two years ago by R. C. B. Thruston.

No. 2587—COAL. *W. D. King's.* Yellow creek, Cumberland river. Average sample collected for coking by R. C. B. Thruston.

No. 2588—COAL. *Dorton Coal Bank,* half a mile above the mouth of Straight creek, near Pineville. Bed 32 inches thick. Collected by R. C. B. Thruston.

A bright, pitch-black coal. Structure imperfectly laminated; fracture generally cuboidal. Very little fibrous coal and no pyrites apparent.

COMPOSITION OF THESE BELL COUNTY COALS.
(Air Dried.)

Number in the Report.	2578	2579	2580	2581	2582	2583	2584	2585	2586	2587	2588	
Hygroscopic moisture	0.86	1.00	0.88	0.80	1.20	1.16	1.40	2.00	1.50	0.92	2.20	
Volatile combustible matters	41.54	34.90	37.72	33.94	37.90	36.84	38.60	35.20	32.90	36.08	33.94	
Coke	57.60	64.10	61.40	65.26	60.90	62.00	60.00	62.80	65.60	63.00	63.86	
Totals	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	
Total volatile matters	42.40	35.90	38.60	34.74	39.10	38.00	40.00	37.20	34.40	37.00	36.14	
Fixed carbon in the coke	50.60	55.70	57.40	58.86	57.78	57.50	57.30	58.80	60.00	58.00	62.06	
Ash	7.00	8.40	4.00	6.40	3.12	4.50	2.70	4.00	5.60	5.00	1.80	
Percentage of sulphur	5.078	1.329	1.783	1.398	1.030	1.535	0.629	0.637	0.692	1.343	0.491	
Character of the coke	{ light spongy.		{ light spongy.									
Color of the ash	{ grey brown.		{ grey purple.		{ grey brown.							

CHEMICAL REPORT.

CHEMICAL REPORT.

Coal No. 2578 is remarkable as being a coking cannel coal. It also contains an exceptional proportion of sulphur, viz.: 5.078 per cent. This, however, may have been an accident of the sampling. This coal and No. 2579 are the only ones of the lot which give an ash percentage above a good average, viz.: 7.00 and 8.40 per cent. severally. All the other coals leave only a moderate or small proportion of ash; No. 2588 giving only 1.80 per cent.

They are all good coals, most of them very good coking coals, as is shown in the results quoted further on.

BELL COUNTY COKES.

No. 2589—COKE. *Forty-two-hours coke, made at Birmingham, Ala., by G. D. Fitzhugh, Esq., from coal taken from the bank of Mr Frederick Barner, on Yellow creek, Bell county, Ky. (see No. 2582), December, 1885.*

No. 2590—COKE (No. 3a). *F. R. Barner's, Yellow creek, Bell county Ky. Forty-two-hours coke, made at Quinnimont, West Virginia, March 22-25, 1886. R. C. B. Thruston.*

No. 2591—COKE (No. 3). *F. R. Barner's, Yellow creek, Bell county. Seventy-two-hours coke, made at Quinnimont, West Virginia. R. C. B. Thruston.*

No. 2592—COKE. *Forty-two-hours coke, made at Birmingham, Alabama, by G. H. Fitzhugh, from coal taken from bank of James Barnett, on Clear creek, fork of Yellow creek, Bell county, Ky., December, 1885. R. C. B. Thruston. (See No. 2581 for the coal.)*

No. 2593—COKE (No. 6). *James Barnett's, Clear Fork of Yellow creek, Bell county, Ky. Forty-eight-hours coke, made at Quinnimont, West Virginia. R. C. B. Thruston.*

No. 2594—COKE (No. 6). *James Barnett's, Clear Fork of Yellow creek, Bell county, Ky. Seventy-two-hours coke, made at Quinnimont, West Virginia, March 20-23, 1886. R. C. B. Thruston.*

No. 2595—COKE (No. 6). *James Barnett's, of Clear Fork of Yellow creek, Bell county, Ky. Forty-eight-hours coke, made at Quinnimont, West Virginia. R. C. B. Thruston.*

No. 2596—COKE. *Forty-two-hours coke, made at Birmingham, Alabama, by G. D. Fitzhugh, from coal taken from the bank of James M. Myers, on Yellow creek, Bell county, Ky., December, 1885. R. C. B. Thruston.*

No. 2597—COKE (No. 4). *James Myers, Yellow creek, Bell county, Ky.* Seventy-two-hours coke, made at Quinnimont, West Virginia, March 20-23, 1886. R. C. B. Thruston.

No. 2598—COKE (No. 4a). *James Myers, Yellow creek, Bell county, Ky. Forty-eight-hours coke, made at Quinnimont, West Virginia, March 20-23, 1886. R. C. B. Thruston.*

COMPOSITION OF THESE BELL COUNTY COKES.
(Air Dried.)

Number in Report.	2589	2590	2591	2592	2593	2594	2595	2596	2597	2598
Moist. exp'd at red heat.										
Carbon in the coke	0.80	0.20	0.50	1.80	0.60	0.40	1.30	2.40	0.40	0.10
Ash	93.90	95.80	94.50	87.20	87.80	89.20	88.90	85.30	90.80	91.50
Totals	5.30	4.00	5.00	11.00	11.60	10.40	9.80	12.30	8.80	8.40
Percentage of sulphur	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
Color of the ash	1.480	1.710	0.959	1.343	1.590	1.590	1.346	1.543	0.547	0.794
Hours of coking	42	48	72	42	48	72	48	42	72	48
Owner of the coal	Frederick Barnett.					James Barnett.				
	James Myers.									

BELL COUNTY COKES—Continued.

No. 2599—COKE. *Forty-two-hours coke, made at Birmingham, Alabama, by G. D. Fitzhugh, from coal taken from the bank of Daniel Howard, on Left-hand Fork of Straight creek, Bell county, Ky., December, 1885.* R. C. B. Thruston.

No. 2600—COKE. *Forty-two-hours coke, made at Birmingham, Alabama, by G. D. Fitzhugh, from coal obtained from bank of Mr. Alf. McTee, on Yellow creek, Bell county, Ky., December, 1885. (The sample of coal from which this coke was made had some earthy matter mechanically mixed.)*

No. 2601—COKE (No. 5). *McTee, Bell county, Ky.* (The smaller sample.)

No. 2602—COKE (No. 5). *Alf. McTee, Yellow creek, Bell county, Ky.* Seventy-two-hours coke, made at Quinnimont, West Virginia, March 20-23, 1886. R. C. B. Thruston.

No. 2603—COKE. *Forty-two-hours coke, made at Birmingham, Alabama, by G. D. Fitzhugh, from coal taken from bank of W. D. King, near Yellow creek, Bell county, Ky., December, 1885.* R. C. B. Thruston.

No. 2604—COKE (No. 7). *W. D. King, Yellow creek, Bell County, Ky.* Forty-eight-hours coke, made at Quinnimont, West Virginia, March 22-24, 1886. R. C. B. Thruston.

No. 2605—COKE (No. 7). *W. D. King, Yellow creek, Bell county, Ky.* Seventy-two-hours coke, made at Quinnimont, West Virginia, March 20-23, 1886. R. C. B. Thruston.

No. 2606—COKE. *Forty-two hours, made at Birmingham, Alabama, by G. D. Fitzhugh, from coal taken from bank of Moses Dorton, at mouth of Straight creek, near Pineville, Bell county, Ky., December, 1885.* R. C. B. Thruston.

No. 2607—COKE (No. 16). *Seventy-two-hours coke; upper bench of Dean seam, made at Quinnimont, West Virginia, March 20-23, 1886. Bell and Knox counties, Ky.* R. C. B. Thruston.

No. 2608—COKE (No. 13).* *Of lower bench of Dean bank, Still-house Branch of Greasy creek, Bell county, Ky.* Seventy-two hours coke, made at Quinnimont, West Virginia, March 20-23, 1886. R. C. B. Thruston.

COMPOSITION OF BELL COUNTY COKES—Continued.
(Air Dried.)

Number in Report.	2599	2600	2601	2602	2603	2604	2605	2606	2607	2608
Moist. expel'd at red heat.	0.20	1.60	0.70	0.40	0.26	0.66	0.20	1.00	0.90	1.80
Carbon in the coke	94.20	89.60	92.70	94.00	92.94	90.54	92.20	92.80	92.70	90.50
Ash	5.60	8.80	6.60	5.60	6.80	8.80	7.60	6.20	6.40	7.70
Totals	100.00	105.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
Percentage of sulphur	0.601	0.491	0.450	0.629	1.033	1.150	0.491	0.603	1.975	0.684
Color of the ash	{ brown	{ light brown	{ brownish grey	{ brown	{ reddish brown	{ brown	{ brown	{ light brown	{ nearly white	{ lt. brownish grey
Hours of coking	42	42	42	72	42	48	72	42	72	72
Owner of the coal	Daniel Howard	Alf. McTee	W. D. King	W. D. King	Moses Dorton	Up'r b'nch. Lw'r b'nch.	Dean Seam.	Dean Seam.	Moses Dorton	Up'r b'nch. Lw'r b'nch.

* These numbers in parentheses were attached to the samples by Mr. Thruston.

These Bell county cokes are generally good, and some of them are very good.

The percentage of carbon in them varies from 95.80 per cent. in No. 2590, to 85.30 per cent. in No. 2596.

The percentage of ash in them varies from 4.00 per cent. in No. 2590, to 12.30 per cent. in No. 2596.

The percentage of sulphur in them varies from 0.450 per cent. in No. 2601, to 1.975 per cent. in No. 2607.

BOYLE COUNTY.

No. 2609—LIMESTONE from quarry of H. Olmstead, near Danville, Boyle county. Sent by Mr. Procter, June 16, 1885. Will it make good lime?

A dull-looking, dark-grey, fine granular lime-rock, containing fragments of fossils.

COMPOSITION.—Air Dried.

Carbonate of lime	82.840 equal to 46.39 per cent. of lime.
Carbonate of magnesia	3.511
Alumina and iron peroxide	3.861
Phosphoric acid ($P_2 O_5$)	819
Siliceous residue	5.620
Moisture, organic matter, loss, etc.	3.349
<hr/>	
	100.000

It would calcine into good lime fit for all ordinary uses in building, etc., and the phosphoric acid it contains would add to its value, when applied to poor soils as a top-dressing.

BREATHITT COUNTY.

COALS.

No. 2610—COAL. Eighty-eight inches. Wolf creek, Breathitt county. Collected by J. M. Hodge.

A weathered sample of splint coal.

No. 2611—COAL. Fifty-nine inches. Berry Turner's. Long's creek, Breathitt county. Sample from the lower thirty inches. Collected by J. M. Hodge.

A pure-looking, pitch-black coal; fracture irregular with shining surfaces. No pyrites apparent, and very little fibrous coal.

No. 2612—COAL. Gouch & Co.; John Little's Branch, North Fork of Kentucky river, Breathitt county. Middle of the 46-inch seam. Collected by J. M. Hodge.

A weathered sample of what appears to be a splint coal.

No. 2613—COAL. Forty-two inches; splint and bituminous. Green Taulbee's. Collected by J. M. Hodge.

A weathered sample.

No. 2614—COAL. Sixty inches. L. H. Nobles, Leatherwood Branch of Lost creek, Breathitt county. Collected by J. M. Hodge.

A much weathered sample of what seems to be a splint coal.

No. 2615—COAL. Forty-three inches. Head of Leatherwood Branch of Lost creek. Collected by J. M. Hodge.

A pure-looking, pitch-black coal. No pyrites apparent, and but little fibrous coal.

No. 2616—COAL. Bituminous coal, 33 inches; cannel coal, 9 inches. Collected by J. M. Hodge.

A weathered sample of the lower 27 inches of the bituminous coal.

No. 2617—COAL. Sample of the cannel coal of the next preceding. Collected by J. M. Hodge.

A much weathered sample.

No. 2618—COAL. Gouch & Co.; John Little Branch, North Fork of Kentucky river. Bituminous coal, 35 inches; cannel coal, 11 inches. Breathitt county. Selected sample of the cannel coal. Collected by J. M. Hodge.

No. 2619—CANNEL COAL. Picked sample. Crawford's. Beginning Branch of Middle Fork of Kentucky river. Breathitt county. Collected by J. M. Hodge.

COMPOSITION OF THESE BREATHITT COUNTY COALS.

(Air Dried.)

Number in Report.	2610	2611	2612	2613	2614	2615	2616	2617	2618	2619
Specific gravity	1.351	1.275	1.410	1.310	not est.	1.384	not est.	not est.	1.177	1.274
Hygroscopic moisture	2.80	2.00	7.40	3.80	9.60	2.80	3.80	0.80	1.20	1.00
Volatile combustible mat.	33.60	35.36	30.20	34.40	29.46	31.16	32.30	41.70	53.80	41.10
Coke	63.60	62.64	62.40	61.80	60.94	66.04	63.90	57.50	45.00	57.90
Totals	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
Total volatile matters	36.40	37.36	37.60	38.20	39.06	33.96	36.10	42.50	55.00	42.10
Fixed carbon in the coke.	54.20	57.36	52.04	51.80	44.14	53.34	48.80	33.30	39.46	46.70
Ash	9.40	5.28	10.36	10.00	16.80	12.70	15.10	24.20	5.54	11.20
Totals	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
Percentage of sulphur	0.695	1.019	0.621	0.586	0.478	0.690	0.840	0.952	0.722	1.120
Character of the coke	dense	light spongy.	pulverulent.	lt. brown-	lt. brown-	lt. brown-	light reddish.	lt. brick	dense.	dense.
Color of the ash	{ brownish grey.	{ white.	{ very light salmon.	{ grey.	{	{	{	{	{	{

CHEMICAL REPORT.

CHEMICAL REPORT.

The *cannel* coals, Nos. 2617, 2618 and 2619 are distinguished by their large proportions of volatile combustible matters—41.70, 53.80 and 41.10 per cent. severally. The best of these, No. 2618, leaves only 5.54 per cent. of ash, and is quite a pure good *cannel* coal. The two others, containing 24.20 and 11.20 per cent. of ash material, are proportionately less valuable. The ash percentage in all these coals, except Nos. 2611 and 2618, is above the average of good coals, varying from 9.40 per cent. in No. 2610, and 10. per cent. in No. 2613, up to 24.20 per cent. in No. 2617.

The much weathered samples, Nos. 2612 and 2614, show very large proportions of hygroscopic moisture. Other weathered samples contain it in from 2.00 to 3.80 per cent. In these cases, the coal further in the bed, where it has not been exposed to the atmospheric agencies, would probably contain very much less moisture.

BUTLER COUNTY.

No. 2620—MINERAL WATER, from *Sunny Lane Spring*, near *Mr. L. B. Orange's, Sunny Lane, Butler county*. Collected by C. C. Cohron, M. D., October, 1885.

COMPOSITION IN 1000 PARTS OF THE WATER.

Carbonate of iron	0.1315	} Held in solution by carbonic acid.
Carbonate of lime . . . . .	.0147
Carbonate of magnesia . . . . .	.0110
Carbonate of soda . . . . .	.0251
Sulphate of lime . . . . .	.0255
Sulphate of potash . . . . .	.0103
Chloride of sodium . . . . .	.0100
Silica0264	
Total saline matters in 1000 of the water	0.2545	

It appears to be a good saline chalybeate water.

CALLOWAY COUNTY.

SOILS, ETC.

No. 2621—VIRGIN SOIL of *Clark's river bottom*. Taken 10 inches deep. Murray, Calloway county. Collected by R. H. Loughridge.

Dried soil in moderately firm clods of a dirty brown-grey color. It all passed through the coarse sieve.* Its siliceous residue left a little sand on the fine sieve.†

No. 2622—*VIRGIN SOIL of the first bottom of Tennessee river.*

W. E. Brown's place, south of Shannon creek. Sample taken to the depth of twelve inches. Growth: white, red, and water oaks, sweet gum, scaly-bark hickory, some poplar, sassafras, ash, papaw, spicewood and redbud. Collected by R. H. Loughridge.

Dried soil of grey-brown color. Clods firm. All passed through the coarse sieve except a very small quantity of shot-iron ore. Its siliceous residue, from digestion in acids, all passed through the fine sieve, except a very small quantity of fine quartz sand.

No. 2623—*VIRGIN SOIL of the Big Barrens, 10 miles northwest of Murray, Calloway county. Sample taken to the depth of 6 inches. Timber: red, post, black-jack and white oaks and hickory, all small. Collected by R. H. Loughridge, 1885.*

Dried soil of a grey-brown color. Clods friable. All passed through the coarse sieve, except a small quantity of small shot-iron ore and vegetable debris. Its siliceous residue all passed through the fine sieve, except a small quantity of fine white sand.

No. 2624—*SUBSOIL of the next preceding, taken from 6 to 10 inches deep. Collected by R. H. Loughridge, 1885.*

Dried subsoil of a lighter and more reddish grey-brown color than the preceding. Clods rather firm. All passed through the coarse sieve, except a small quantity of shot-iron ore and vegetable debris. Its siliceous residue all passed through the fine sieve, except a small quantity of fine white sand.

No. 2625—*VIRGIN SOIL OF UPLAND, 1 mile north of New Providence, Calloway county. Taken to the depth of 8 inches. Timber: red and post oaks and hickory. Collected by R. H. Loughridge.*

* Coarse sieve has 64 meshes to the centimeter square.

† Fine sieve has 1600 meshes to the centimeter square.

Dried soil of a light-grey-brown color. Clods friable. All passed through the coarse sieve, except a small quantity of vegetable debris and small shot-iron ore. Its siliceous residue all passed through the fine sieve.

No. 2626—*SUBSOIL of the next preceding, taken 8 to 12 inches deep. Collected by R. H. Loughridge.*

Dried soil of a lighter color and more reddish than the preceding; clods more firm. All passed through the coarse sieve except a small quantity of vegetable debris. Its siliceous residue all passed through the fine sieve.

No. 2627—*VIRGIN SOIL of the second bottom of Tennessee river; W. E. Brown's place, south of Shannon creek, Calloway county. Taken to the depth of 6 inches. Growth: Spanish, red and white oaks, poplar, gum, chestnut and black locust. Collected by R. H. Loughridge, 1885.*

Dried soil of a dark grey-brown color. Clods friable. All passed through the coarse sieve except a small quantity of vegetable debris and small shot-iron ore.

No. 2628—*SUBSOIL of the next preceding, taken to depth of 6 to 12 inches. Collected by R. H. Loughridge.*

Dried soil of a light reddish-grey-brown color. Clods friable. All passed through the coarse sieve except a small quantity of vegetable debris. Its siliceous residue all passed through the fine sieve, except a small quantity of fine white sand and a few small specks of mica.

No. 2629—*VIRGIN UPLAND SOIL, 5 miles east of Murray, Calloway county. Taken to the depth of 10 inches. The soil is dark for one inch, and then a light-brown loam to the subsoil. Growth: red oak chiefly, some post oak and hickory. Collected by R. H. Loughridge.*

Dried soil of a light yellowish-grey-brown color. Clods somewhat firm. All passed through the coarse sieve except a small quantity of vegetable debris and fine shot-iron ore. Its siliceous residue all passed through the fine sieve except a small quantity of fine sand.

No 2630—**VIRGIN SOIL.** *Upland sandy loam of the "Coalings" of the south-east corner of Calloway county. Taken to the depth of 6 inches. Original growth: red, black Spanish and post oaks and hickory.* Collected by R. H. Loughridge.

Dried soil of a dirty brownish-buff color. Clods quite friable. All passed through the coarse sieve except a little small shot-iron ore. Its silicious residue all passed through the fine sieve except 2.8 per cent. of fine white quartz sand.

No. 2631—*SUBSOIL* of the next preceding. *Sample from depth between 6 and 12 inches.* Collected by R. H. Loughridge.

Dried subsoil of a brownish-yellow color. Clods moderately firm. All passed through the coarse sieve except a small quantity of small shot-iron ore. Its silicious residue all passed through the fine sieve except 2.5 per cent. of fine quartz sand.

No. 2632—*VIRGIN SOIL of Post Oak Flatwoods, 2 miles east of the Murray and Paris road, near the Tennessee State line. Sample taken to the depth of 6 inches. Timber: post and red oaks. Collected by R. H. Loughridge.*

Dried soil of a dirty grey-buff color. Clods friable. All passed through the coarse sieve except a small quantity of fine shot-iron ore. Its silicious residue left 5.8 per cent. of fine white sand on the fine sieve.

No. 2633—SUBSOIL of the next preceding. Sample from depth between 6 and 12 inches. Collected by R. H. Loughridge.

Dried subsoil of a light-yellowish-grey color. Clods somewhat firmer than of the preceding. Coarse sieve removed from it only a small quantity of small shot-iron ore. Fine sieve separated 5.05 per cent. of fine white sand from its silicious residue.

No. 2634—VIRGIN BOTTOM SOIL of *Shannon creek*. *Taken to*
the depth of 6 inches. A dark-blackish loam. Growth:
white and red oaks, poplar and some walnut. Collected
by R. H. Loughridge.

The coarse sieve separated a considerable quantity of shot-iron ore. Fine sieve removed 2.05 per cent. of fine sand from silicious residue.

No. 2635—SUBSOIL of next preceding. Taken at depth of 6 to 12 inches. A stiff yellowish clay. Collected by R. H. Loughridge.

Dried subsoil of a light-grey yellow color. Clods quite firm. Coarse sieve removed a small quantity of shot-iron ore. Fine sieve separated 2.2 per cent. of fine white sand.

COMPOSITION OF THESE CALLOWAY COUNTY SOILS AND SUBSOILS.

(Calculated Dried at 212° F.)

Number in Report.	2621	2622	2623	2624	2625	2626	2627	2628	2629	2630	2631	2632	2633	2634	2635
Organic and volatile matters															
Alumina and manganese oxide	3.475	6.080	3.540	2.632	2.862	2.569	5.482	2.627	3.000	2.497	2.999	2.650	2.188	5.848	3.500
Iron peroxide	3.612	8.171	3.190	5.239	3.321	4.920	5.595	5.333	4.395	1.924	4.725	2.890	4.982	4.332	
Lime carbonate	2.701	4.862	2.434	4.145	3.060	4.365	3.114	2.220	2.020	4.250	2.564	2.836	4.955	5.575	
Magnesia . . . . .	.021	.280	.096	.125	.046	.147	.234	.146	.146	.131	.044	.052	.090	.163	.132
Phosphoric acid (P ₂ O ₅) . . . . .	.461	.180	.137	.234	.215	.062	.180	.124	.124	.118	.094	.086	.076	.378	.394
Potash extracted by acids . . . . .	.662	.288	.093	.184	.062	.124	.151	.124	.124	.124	.094	.094	.094	.249	.159
Soda extracted by acids . . . . .	.461	.064	.389	.399	.399	.097	.119	.097	.097	.097	.097	.097	.097	.127	.064
Water expelled at 360° F. . . . .	.100	.2135	.0800	.860	.834	.755	.401	.859	.834	.453	.679	.522	.323	.344	
Sand and insoluble silicates	88.32	77.193	88.383	86.312	81.374	86.356	82.345	86.320	88.334	92.633	86.425	90.900	84.356	84.426	
To als	99-308	100.316	100.052	99-747	99.993	99.392	99.092	100.425	100.786	99.903	99.769	100.000	99.815	100.013	99.906
Hygroscopic moisture															
Potash in silicons residue	1.450	2.650	1.150	1.250	0.950	1.125	1.500	1.050	1.100	0.875	1.650	1.150	1.300	1.850	1.700
Soda in silicons residue	1.447	1.572	1.157	1.245	1.204	1.167	1.366	1.300	1.397	1.005	1.866	1.090	1.439	1.468	1.386
Soda in silicons residue	0.535	2.53	.331	.792	.374	.339	.664	.411	.424	.274	.455	.424	.399	.588	

The alluvial river bottom soils, Nos. 2621, 2622, 2627, 2628, 2634 and 2635, with the single exception of No. 2621, from Clark's river bottom, have the composition of good fertile soils, containing all the essential elements and organic matters in more than average proportions, and with good culture and sufficient drainage ought to be quite productive. No. 2621 is quite deficient in lime and phosphoric acid, and would, doubtless, respond favorably to applications of super-phosphates or other fertilizers containing these essential ingredients.

Lime is apparently quite deficient, not only in this but in soils Nos. 2625, 2626 and 2631, and is below a good average in Nos. 2623, 2624 and 2633. Top-dressings of slack lime or ground limestone would, no doubt, be profitable to all these soils. Phosphoric acid is very deficient in soils Nos. 2621, 2625 and 2626, and in proportions below a good average in Nos. 2623, 2624, 2629, 2630, 2631 and 2632. Potash is very deficient in Nos. 2630 and 2632, and below a good average proportion in No. 2623. No. 2630 appears, by its chemical composition, to be the poorest of all these soils; but this, as well as all the others, if well drained and properly cultivated, with the use of suitable manures or fertilizers, may be made to produce good crops.

SANDS OF CALLOWAY COUNTY.

No. 2636—FINE MICACEOUS SAND, *slightly calcareous*. *Cretaceous formation*, 2 miles north-east of New Concord. Collected by R. H. Loughridge.

A very fine-grained white sand, containing minute specks of mica. All passed through the coarse sieve. Its silicious residue, from digestion in acids, all passed through the fine sieve except 4.45 per cent. of fine white quartz grains with small specks of mica.

No. 2637—SAND apparently similar to preceding, but slightly colored brownish with iron peroxide. Collected by R. H. Loughridge.

All passed through the coarse sieve. The fine sieve separated from its silicious residue only 6.75 per cent. of small quartz grains with mica scales.

COMPOSITION OF THESE CALLOWAY COUNTY SANDS. (Calculated Dried at 212° F.)

Number in Report.	2636	2637
Organic and volatile matters	1.815	0.690
Alumina, iron peroxide and P_2O_5	.605	.505
Lime carbonate	.090	.095
Magnesia	.232	trace.
Potash removed by acids	.044	not est.
Soda removed by acids	not est.	not est.
Water expelled at 380° F.		not est.
Sand and insoluble silicates	97.395	98.145
Total	100.181	99.435
Hygroscopic moisture	0.075	0.025
Total potash	0.514	0.289

These sands might be useful in glass-making or to mix with tough clays for pottery, etc.

CALLOWAY COUNTY.

CLAYS, ETC.

No. 2638—CLAY. *Siliceous earth (or decomposed chert) from Brandon's Mill. Lower Carboniferous siliceous group. Calloway county. Collected by R. H. Loughridge.*

A very fine-grained, friable, white mass, containing small pieces of undecomposed chert. Powder harsh to the feel.

No. 2639—CLAY. *Tertiary, half a mile south of Wyatt's school-house, north-west part of Calloway county. Collected by R. H. Loughridge, June 17, 1885.*

A white clay. Powder feels soft. Contains about 21 per cent. of fine white sand.

No. 2640—WHITE PIPE-CLAY. *Below Quaternary gravel. R. Morris', east of New Providence. Used for pottery. Collected by R. H. Loughridge.*

Color, light-buff-grey, with some darker streaks. Powder soft, contains a small proportion of very fine sand.

No. 2641—BLACK PYRITOUS PLASTIC CLAY. *Tertiary; below the white pipe-clay. R. Morris', east of New Providence.*

Indurated, imperfectly laminated, fine-grained. Powder soft. Light slate color. Contains a few small grains of pyrites.

No. 2642—BLACK JOINT-CLAY or so called soapstone. *Lignite* Tertiary. Murray, Calloway county. Collected by R. H. Loughridge.

Fine grained, indurated clay, showing minute specks of mica. Tough. Fracture irregular, with imperfect lamination. Said not to glaze in pottery. Washed out 39.78 per cent. of light-brown, fine sand, containing a few small mica scales.

No. 2643—CLAY from Russell's Pottery, 6 miles east of Murray. Collected by R. H. Loughridge.

Nearly white, with a few small brownish ochreous veins.

No. 2644—DARK CLAY. (*Bluish when wet.*) *Mahan's, 6 miles east of Murray.* Collected by R. H. Loughridge.

Color, purplish-slate-grey. Contains minute mica scales, and about 39 per cent. of fine white sand, with minute mica scales.

No. 2645—BLACK PLASTIC CLAY underlying white clay at
Rufus Morris', east of New Providence. Tertiary. Col-
lected by R. H. Loughridge.

Resembles the next preceding. Imperfectly laminated.

No. 2646—YELLOW CLAY or *ochre*. Wadesboro. Collected by
R. H. Loughridge.

Of a handsome yellow ochre color. Calcines of a handsome red color. Fuses before the blow-pipe. Resembles No. 2572, of Ballard county (which see). Laminated, Laminæ varying in depth of tint.

COMPOSITION OF THESE CALLOWAY COUNTY CLAYS.
(Air Dried.)

ONE CALLO
(Air Dried.)

Number in Report.	2638	2639	2640	2641	2642	2643	2644	2645	
Silica	87.300	46.020	61.680	56.680	66.380	57.840	54.140	57.400	
Alumina	10.480	38.980	28.500	29.700	16.480	30.340	32.140	29.440	
Iron peroxide . . . . .	.045	.773	1.680	1.480	3.500	1.180	1.040	1.340
Lime . . . . .	.281	.136	.101	.136	.281	.213	.011	.134
Magnesia . . . . .	.888	.309	1.158	1.004	.497	.050	.032	.245
Potash . . . . .	.209	.172	.822	.274	.928	.618	.965	.522
Soda . . . . .	.797	13.610	5.923	10.581	11.774	.519	.468	.437
Water, etc.	100.000	100.000	100.000	100.000	100.000	100.000	100.000	100.000	
Totals	21.000	not est.	not est.	not est.	not est.	not est.	39.780	not est.	
Sand	not est.							39.000	not est.

The decomposed chert No. 2638, is mainly very fine and pure siliceous sand. It would serve well to mix with tough clay to reduce its shrinkage, etc. It might answer to make what are called Bath bricks, used for scouring purposes or polishing, and possibly could be used as an ingredient of white glass.

These are mostly good refractory clays. Those which contain the least of fluxing materials, such as iron oxide, lime, potash, soda or magnesia, are the most refractory, and would make good fire-brick or linings for furnaces, etc. Many of them would make good white pottery ware or terra-cotta.

No good reason appears from the analysis why No. 2642 should not glaze,* as, on testing it for sulphate of lime, very little was found in its composition.

The least refractory of these clays is, undoubtedly, No. 2642, which contains 3.500 per cent. of iron peroxide; 0.928 per cent. of potash, etc. The large proportions of these fluxing materials is, however, partly neutralized by its large proportion of silica.

The ochreous clay—yellow ochre—might be used as a cheap pigment, either raw or calcined. (See remarks on Ballard county clays, etc.)

CLAY COUNTY.

COALS.

No. 2647—COAL. *Fifty-one inches. Isaac Jackson's, left Fork of Goose creek, Clay county.* Collected by G. M. Hodge, December, 1885.

A pure-looking coal. No apparent pyrites and but little fibrous coal. Ferruginous stains on some of the pieces.

No. 2648—COAL. *Thirty-one inches. T. T. Garrard's mine, east side of Goose creek, at its forks.* Sample from 200 feet under. Collected by G. M. Hodge, December, 1885.

A pure-looking, pitch-black coal, with very little fibrous coal and only a few specks of pyrites.

* With common salt alone.

No. 2649—COAL. *Thirty-nine inches. Mrs. S. A. White's, Salt Works mine.* Sample from twenty feet under. Collected by G. M. Hodge. Resembles the preceding. No pyrites apparent.

No. 2650—COAL. *Forty-five inches. G. L. Hornsby's, Laurel creek, Clay county.* Collected by G. M. Hodge.

Apparently a good splint coal. No apparent pyrites, but some ferruginous stains. Seems to be a somewhat weathered sample.

No. 2651—COAL. *Forty-seven inches. G. M. Jones', Beech creek, Clay county.* Sample of the upper 32 inches. Collected by G. M. Hodge. Somewhat weathered.

No. 2652—COAL. *Forty-seven inches. G. M. Jones', Beech creek.* Sample of the lower 15 inches. Collected by G. M. Hodge.

A much weathered sample.

No. 2653—COAL. *Bituminous, 30 inches; cannel coal, 5 inches. J. T. Smith's, Tom's Branch, Left Fork of Goose creek.* Sample of the bituminous coal from 15 inches under. Collected by G. M. Hodge. (See No. 2647.)

A much weathered sample, with reddish, ferruginous incrustation.

No. 2654—COAL. *Thirty-eight inches. Alvis Hubbard's, Katy's creek. Red Bird creek, Clay county.* Collected by G. M. Hodge.

A somewhat weathered sample.

No. 2655—CANNEL COAL. *J. T. Smith's, Tom's Branch Goose creek.* (See No. 2653.) Bituminous coal, 30 inches; cannel coal, 5 inches.

COMPOSITION OF THESE CLAY COUNTY COALS.

(Air Dried.)

Number in Report.	2647	2648	2649	2650	2651	2652	2653	2654	2655
Specific gravity	1.288	1.287	1.278	1.292	1.313	not est.	1.290	1.160	
Hygroscopic moisture	1.10	1.20	1.48	0.92	0.42	2.80	1.60	0.30	
Volatile combustible matters	35.60	38.10	35.92	34.84	37.54	32.38	34.28	44.16	
Coke	63.30	60.70	62.60	63.70	61.54	67.20	67.80	55.54	
Totals	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	
Total volatile matters	36.70	39.30	37.40	36.30	38.46	32.80	32.20	35.88	44.46
Carbon in the coke	56.90	54.90	54.70	57.70	53.44	35.20	57.00	54.82	43.74
Ash	6.40	5.80	7.90	6.00	8.10	32.00	10.80	9.30	11.80
Totals	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	
Percentage of sulphur	0.885	1.793	0.885	0.531	1.601	6.042	1.178	1.766	1.244
Character of the coke	light spongy.		spongy.		spongy.		dense.		
Color of the ash	lt. brownish-grey.		light lilac-grey.		lt. brownish-grey.		dark brown.		

CHEMICAL REPORT.

CHEMICAL REPORT.

The large proportion of ash of No. 2652, viz.: 32 per cent., greatly reduces its value, especially for transportation, and its more than 6 per cent. of sulphur would prevent its profitable use in the working of iron. Nos. 2655, 2654 and 2653, containing severally 11.80, 9.30 and 10.80 per cent. of ash, are proportionately reduced in value, especially for coking. The lowest ash proportions are found in Nos. 2648, 2650 and 2647, being 5.80, 6.00 and 6.40 severally. The large amount of ash in several of these Clay county coals would not prevent their profitable use as fuel in the vicinity of the several beds.

CLINTON COUNTY.

MINERAL WATER.

No. 2656—MINERAL WATER from *Sewell's Mountain*, near Albany, Clinton county.

Near the summit of Poplar or Sewell's Mountain. Issues from beneath a heavy ledge of carboniferous sandstone or conglomerate. Flow small. Temperature 52° F. Collected by R. H. Loughridge.

COMPOSITION IN 1000 PARTS OF THE WATER.

Iron carbonate	0.320	Held in solution by carbonic acid.
Lime carbonate . . . . .	.011
Magnesia carbonate . . . . .	.021
Silica . . . . .	.020
Potash and soda salts in minute quantity	not est.	
Total saline matters in 1000 parts of the water	0.372	

A weak chalybeate water. Good of its kind.

FLEMING COUNTY.

MINERAL WATERS.

No. 2657—CHALYBEATE WATER from *Fox Spring*. Geological position: near the top of the corniferous group. Collected by W. M. Linney.

No. 2658—WHITE SULPHUR WATER. *Fox Springs*. Geological position: Black slate. Collected by W. M. Linney.

COMPOSITION IN 1000 PARTS OF THE WATER.

Number in Report.	2657	2658
Carbonate of iron	0.0130	0.0016
Carbonate of lime . . . . .		.0982
Carbonate of magnesia . . . . .		.0430
Sulphate of iron . . . . .	.0175	
Sulphate of potash . . . . .	.0244	.0142
Sulphate of soda . . . . .	.0424	.0460
Sulphate of lime . . . . .	.0483	
Sulphate of magnesia . . . . .	.0485	
Chloride of sodium	trace.	.0427
Carbonate of soda . . . . .		.0538
Silica . . . . .	.0328	.0238
Organic matters and loess . . . . .	.0121	.0802
Total	0.2390	0.4035

No. 2657 is a good saline chalybeate water. No. 2658 is an alkaline saline chalybeate, containing much less of salts of iron than the other.

FULTON COUNTY.

No. 2659—GREY SILT OR LOESS. *Near the top of the bluff at Hickman, Fulton county.* Collected by R. H. Loughridge.

Dried silt of greyish-cinnamon color. Clods friable. All passed through the coarse sieve, except a few small rock fragments. Its siliceous residue, from digestion in acids, all passed through the fine sieve.

COMPOSITION.—(Air Dried)

Alumina and manganese oxide	4.062
Iron peroxide	2.125
Lime carbonate	14.900
Magnesia carbonate	7.670
Phosphoric acid (P_2O_5) . . . . .	.173
Potash extracted by acids . . . . .	.521
Soda extracted by acids	1.082
Sand and insoluble silicates	67.295
Moisture, organic matters, etc.	2.172
Total	100.000
Potash in siliceous residue	1.410
Soda in siliceous residue	1.268

(See No. 2142 in previous report for analysis of the lower portion of this bed.)

GRAVES COUNTY.

SOILS.

No. 2660—VIRGIN SOIL of *black-jack oak barren, three miles north-west of Mayfield.* Taken to the depth of 10 inches. Growth: chiefly black-jack oak and some young red oaks. Collected by R. H. Loughridge.

Dried soil of a grey-brown color. Clods friable. All passed through the coarse sieve.* Its siliceous residue, from digestion in acids, all passed through the fine sieve.†

No. 2661—SUBSOIL of the next preceding. Taken from 6 to 12 inches deep. Collected by R. H. Loughridge.

Dried subsoil of a grey-buff color. Clods comparatively firm. All passed through the coarse sieve. Its siliceous residue, from digestion in acids, all passed through the fine sieve.

COMPOSITION OF THESE GRAVES COUNTY SOILS.

(Calculated Dried at 212° F.)

Number in Report.	2660	2661
Organic and volatile matters	2.639	2.187
Alumina and manganese oxide	2.636	3.511
Iron peroxide	1.756	2.484
Lime carbonate . . . . .	.096	.147
Magnesia . . . . .	.159	.235
Phosphoric acid (P_2O_5) . . . . .	.084	.049
Potash extracted by acids . . . . .	.149	.110
Soda extracted by acids	not est.	.039
Water expelled at 380-400° F. . . . .	.696	1.156
Sand and insoluble silicates	91.295	89.813
Total	99.510	99.731
Hygroscopic moisture	0.915	0.575
Potash in siliceous residue	1.732	1.827
Soda in siliceous residue	1.461	.870
Character of the soil	{ virgin surface.	subsoil.

These may be characterized as light soils, containing moderate, or small proportions of organic matters, lime and phosphoric acid, with an average amount of potash. Manures would be required to keep up fertility.

* With 64 meshes to the centimeter square.

† With 1600 meshes to the centimeter square.

GRAVES COUNTY.

CLAYS.

No. 2662—ARENACEOUS CLAY (*from decomposing chert?*).

Railroad cut, 3 miles north of Boaz station. Quaternary.
Collected by R. H. Loughridge.

Lump of the hardness of chalk, of a fine granular texture; light-brownish-grey color. A portion of a small, whitish, rounded chert pebble in the sample. Somewhat plastic, very difficult to fuse before the blow-pipe.

No. 2663—CLAY, *3 miles west of Linnville. Lagrange Tertiary group.* Collected by R. H. Loughridge.

Dried clay of a light-brownish-grey color. Fine textured. Infusible before the blow-pipe.

No. 2664—WHITISH PIPE-CLAY. *South of Guill Hill. Railroad cut, 3 miles south of Wingo. Tertiary.* Collected by R. H. Loughridge.

Dried clay of a light-brownish-grey color; nearly white. Of very difficult fusion before the blow-pipe.

No. 2665—CLAY. *Boaz Station.* Collected by R. H. Loughridge.

Dried clay, nearly white (light-brownish-grey). Fine textured. Very difficult to fuse before the blow-pipe.

No. 2666—CLAY *from Howard's pottery, at Bell City.* Collected by R. H. Loughridge.

Dried clay, nearly white (of a light-brownish-grey color), with some ferruginous stains. Fine textured. Infusible before the blow-pipe.

COMPOSITION OF THESE GRAVES COUNTY CLAYS.

(Air Dried.)

Number in Report.	2662	2663	2664	2665	2666
Silica	76.780	62.680	75.120	61.920	56.980
Alumina	14.740	25.880	15.960	30.060	32.160
Iron peroxide	1.640	2.900	1.420	.300	2.160
Lime	trace.	trace.	trace.	trace.	trace.
Magnesia . . . . .	.389	.319	.317	.064	.209
Potash	1.440	1.147	1.351	1.602	.888
Soda . . . . .	.117	.928	.245	.239	.111
Water, etc.	4.894	6.146	5.587	5.815	7.542
Total	100.000	100.000	100.000	100.000	100.000
Fine sand	2.400	not est.	not est.	not est.	16.44

The arenaceous clay, No. 2662, contains enough alumina to make it plastic enough for the manufacture of good fire-brick, etc. No. 2664 has an analogous composition, and had, probably, the same origin. The other clays are quite plastic, very refractory, and good for the manufacture of light-colored or white pottery-ware, fire-brick, etc., and terra-cotta.

HARLAN COUNTY.

COALS.

No. 2667—COAL. *Sixty-three inches. Dale Bledsoe's, Reuben Branch of Beech Fork of Middle Fork of Kentucky river.* Collected by G. M. Hodge.

A somewhat weathered sample. Has no apparent pyrites.

No. 2668—COAL (sample 4). *Three and a quarter miles above the mouth of Clover Lick creek of Poor Fork of Cumberland river. Outcrop sample from the exposure in the bed of the creek. Forty-one inches thick. A seam 75 to 100 feet below sample 3.* Collected by R. C. B. Thruston.

A slightly weathered sample.

No. 2669—COAL. *Six feet five inches thick. Right bank of Looney creek, about 2 miles above the mouth.* Collected by T. H. Morgan, August 24, 1885.

A much weathered sample, containing a few pieces of bright hard coal.

No 2670—COAL on the land of E. Dickson, on Tantrough Branch of Poor Fork of Cumberland river, 20 miles from Mount Pleasant. Coal No. 1. ? Collected by R. C. B. Thruston.

A much weathered sample.

No. 2671—COAL a quarter of a mile up Tyrey's Branch of Clover Lick creek (3 miles above its mouth) of Poor Fork of Cumberland river. Collected by R. C. B. Thruston. The coal shows, across Tyrey's Branch, 41 inches thick.

A weathered sample of the outcrop.

No. 2672—COAL in Fickle's Cove of Looney creek, on J. Jenkins' land. Coal 6 feet 4 inches thick.

A weathered sample.

No. 2673—COAL. Right bank of Looney's creek, about 2 miles above the mouth. Coal 4 feet thick. Collected by T. H. Morgan, August 24th, 1885.

A much weathered sample.

No. 2674—COAL (sample No. 5). Garner's Hollow, 15 miles above the mouth of Poor Fork of Cumberland river. Cannel coal 42 inches, on land of John L. Cornett, beneath cannel shale. Collected by R. C. B. Thruston.

No. 2675—COAL (sample No. 6). Thirty-six inches thick. Garner's Spring, 15 miles above the mouth of Poor Fork. One hundred and forty feet above black limestone.

A much weathered and dirty sample. (Dust was sifted out before analyzing.)

No. 2676—COAL (sample No. 7). Head of Island Branch of Poor Fork of Cumberland river, 16 miles from Mount Pleasant; 180 feet above black limestone. Coal 51 inches thick, on land of John L. Cornett. Collected by R. C. B. Thruston.

A much weathered sample. The dust was sifted out before analyzing.

No. 2677—COAL (sample No. 9). Head of Island Branch of Poor Fork of Cumberland river. Soft coal below sample 8, 23 inches thick. Collected by R. C. B. Thruston.

Somewhat weathered. The sample contained some slaty pieces, which were retained when it was analyzed.

COMPOSITION OF THE ABOVE DESCRIBED HARLAN COUNTY COALS.
(Air Dried.)

Number in Report.	2667	2668	2669	2670	2671	2672	2673	2674	2675	2676	2677
Hygroscopic moisture	1.60	1.12	3.40	1.60	1.40	2.30	2.50	1.00	4.62	6.08	1.90
Volatile combustible matters	33.30	33.68	31.08	35.00	32.20	33.30	34.30	29.50	32.98	32.72	36.00
Coke	65.10	65.20	65.52	63.40	66.40	64.40	63.20	69.50	62.40	61.20	62.10
Totals	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
Total volatile matters	34.90	34.80	34.48	36.60	33.60	35.60	36.80	30.50	37.60	38.80	37.90
Carbon in the coke	49.70	63.10	62.52	57.40	57.20	57.20	58.70	31.60	58.30	58.20	56.10
Ash	15.40	2.10	3.00	6.00	9.20	7.20	4.50	37.90	4.10	3.00	6.00
Totals	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
Percentage of sulphur	1.491	0.420	0.365	0.558	0.742	0.502	0.502	0.613	0.475	0.311	0.461
Character of the coke	{ spongy.			{ friable.			{ dense.			pulverulent.	
Color of the ash	{ light			{ lt. purple			{ reddish			very lt. brown.	
	{ brown.			{ brown.			{ brown.			light brown.	
	{ grey.			{ grey.			{ grey.			brown.	

No. 2674 contains so much ash material, 37.9 per cent., as to cause it to be unprofitable for transportation or the manufacture of coke. The profitable use of its 61.1 per cent. of combustible materials could only be made near the bed. No. 2667 also contains more than a good average of ash. Several of these coals, especially those with little ash and sulphur, would make good coke. No. 2669, which gives only 3 per cent. of ash, presents the apparent anomaly of yielding a friable coke. This can only be explained by the fact that it was a much weathered sample. Very probably the coal, deeper in the bed where it has not been altered by the atmospheric agencies, will be found to give a spongy coke, like its neighboring coal in this schedule, No. 2668, which it resembles in composition.

HARLAN COUNTY COALS, ETC.—Continued.

No. 2678—COAL (sample 10). *from near the mouth of Island Branch of Poor Fork of Cumberland river, 16 miles from the Court-house of Harlan county. Coal 36 inches, with two thin partings of fibrous coal. Land of John L. Cornett.* Collected by R. C. B. Thruston.

A slightly weathered sample, containing some slaty pieces. Part of it is bright fat coal.

No. 2679—COAL (sample 13). *George Turner's bank, 1 mile above Mount Pleasant, in Big Black Mountain, on Clover Fork of Cumberland river. Coal 48 inches. No parting.* Collected by R. C. B. Thruston.

A bright pitch-black coal, fracture generally cuboidal and irregular. Very little fibrous coal apparent, but some granular pyrites.

No. 2680—COAL (sample 14). *Mr. Silas Woodson Kelly's, Yocum's creek, Clover Fork of Cumberland river. Sample from 2 seams, 22 and 17 inches thick severally, separated by 8 inches of shale. Lower 17-inch layer is very hard and rich.* Collected by R. C. B. Thruston.

Apparently a pretty good, firm splint coal, not much fibrous coal between the laminæ, and no apparent pyrites.

No. 2681—BITUMINOUS SHALE (sample 15). *Sharpe's creek of Yocum's creek of Clover Fork of Cumberland river. Land of John Farley. Shale 15 inches thick, above coal 25 inches thick.* Collected by R. C. B. Thruston.

No. 2682—COAL (sample No. 16). *Twenty-five inches of the bed above described.* Collected by R. C. B. Thruston. A bright pitch-black coal, breaking generally irregular cuboidal. Very little fibrous coal and no pyrites apparent in the sample.

No. 2683—COAL (sample 17). *Right Hand Fork of Yocum's creek of Clover Fork of Cumberland river. Land of Wright Winn.* Collected by R. C. B. Thruston. Coal $31\frac{1}{2}$ inches in all, with a clay parting.

Portions breaking somewhat irregularly; pitch-black, with shining surfaces. Other portions dull black, breaking in irregular laminæ, with but little fibrous coal between them, and no apparent pyrites.

No. 2684—COAL (sample 18). *Turkey-pen Branch of Poor Fork, 14 miles above Harlan Court-house. Land of Jonathan Cornett. Coal 39 inches thick.* Collected by R. C. B. Thruston. Sample from the lower 39-inch seam.

A somewhat weathered sample of what appears to be a splint coal, much of the sample in a powdered condition. Some fibrous coal and softer, brighter lumps in the sample.

No. 2685—COAL (sample 19). *On Isaac Creech's land on Mud Lick Fork of Seagreaves creek of Clover Fork of Cumberland river.* Collected by R. C. B. Thruston. Sample from the 23, 11 and 5-inch seams, which are parted by thin shale layers.

A pitch-black coal, breaking generally into irregular laminæ with shining surfaces. Some pieces more dull. Some bright scales of pyrites and fibrous coal apparent.

No. 2686—COAL (sample 20). *Child's creek of Clover Fork of Cumberland river.* Collected by R. C. B. Thruston. Sample of 40 inches of the 44-inch seam near the bottom of the bed.

Sample from the outcrop, badly weathered. The bed has a soil roof and is opened at the side of a bridle path.

No. 2687—COAL (sample 21). *Child's creek of Clover Fork of Cumberland river. Three hundred feet below sample 20.* Collected by R. C. B. Thruston. Sample from the 21, 5, and 11-inch seams. One shale parting. Sandstone roof.

A hard splint coal, dull black, with but little fibrous coal and no apparent pyrites.

No. 2688—COAL (sample 22). *On Buck Branch of Child's creek of Clover Fork.* Sample includes all the 3 seams of the bed, 10, 13 and 11 inches severally, which are parted by thin layers of shale. Collected by R. C. B. Thruston.

Generally splint coal. But little fibrous coal and no pyrites apparent. Some ferruginous incrustation. Portions breaking irregularly, with pitch-black, irregular surfaces.

COMPOSITION OF THE ABOVE DESCRIBED HARTLAN COUNTY COALS.
(Air Dried.)

Number in Report.	2678	2679	2680	2681	2682	2683	2684	2685	2686	2687	2688
Hygroscopic moisture	2.02	1.76	1.60	1.04	1.50	1.52	1.84	1.58	6.18	2.20	1.80
Volatile combustible matters	32.98	34.64	37.70	21.88	35.30	33.00	31.12	31.82	34.24	33.52	35.00
Coke	65.00	63.60	60.70	77.08	63.20	65.48	67.04	66.60	59.58	64.28	63.20
Totals	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
Total volatile matters	35.00	36.40	39.30	22.92	36.80	34.52	32.96	33.40	40.42	35.72	36.80
Carbon in the coke	52.70	60.50	54.84	29.60	60.24	51.96	62.28	63.20	52.88	55.72	57.30
Ash	12.30	3.10	5.86	47.48	2.96	13.52	4.76	3.40	6.70	8.56	5.90
Totals	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
Percentage of sulphur	0.546	0.904	0.958	5.436	0.684	0.794	1.288	0.519	0.656	0.986	
Character of the coke											
Color of the ash											

GEOLOGICAL SURVEY

The bituminous shale, No. 2681, with its 47.48 per cent. of ash, yet contains 51.48 per cent. of combustible matters, volatile and fixed, including 5.436 per cent. of sulphur. It would not bear the cost of distant transportation, nor could it well be used for fuel for most manufacturing purposes, yet it may find profitable application in the close vicinity of the bed.

Several of these coals above described are very good coking coals, especially those which leave but little ash and contain a small proportion of sulphur. Coal No. 2686, which contained so much moisture—6.18 per cent., and left only a pulverulent coke—being a much weathered sample, may be found a good coking coal deeper in the bed, where it has been protected from the atmospheric agencies.

HARLAN COUNTY COALS—Continued.

No. 2689—COAL (sample 23). *Buck Branch of Child's creek of Clover Fork. Three hundred and twenty-five feet above sample 22.* Collected by R. C. B. Thruston. Sample from all the coals of the bed.

A mixed sample. Some splint coal, with fibrous coal between the laminæ, but no apparent pyrites; other portions breaking irregularly, with pitch-black, shining surfaces.

No. 2690—COAL (sample 24). *Baily Hollow of Clover Fork, 20½ miles above Mount Pleasant; 135 feet above drainage.* Collected by R. C. B. Thruston.

Sample from 36 and 8-inch layers. The 36-inch coal is a fat coking coal, with four bands of fibrous coal. The 8-inch coal below is harder, with some little splint coal.

The bed has five several seams of coal, in all 65 inches, separated by five layers of shale, in all 41 inches. With sandstone roof.

No. 2691—COAL (sample 25). *Head of Child's creek of Clover Fork, within 20 yards of the State line, 360 feet above sample 20. Sample from the upper 24-inch coal.*

The bed contains four seams of coal, separated by three layers of shale, with a conglomerate sandstone roof.

The sample seems to have been weathered.

No. 2692—COAL (sample 26), of the 24-inch splint coal in the bed described under the next preceding number. Collected by R. C. B. Thruston.

Contains some fibrous coal, but no apparent pyrites. Some pieces break irregularly, with bright shining, pitch-black, irregular surfaces.

No. 2693—COAL (sample 27). *Near head of Child's creek of Clover Fork, 380 feet below sample 26. (The same as sample 20 (No. 2686), but from a better opening. This sample not as much weathered as that.)*

Mostly splint coal, showing but little fibrous coal and no apparent pyrites. Some portions softer coal, breaking somewhat irregular, with bright irregular pitch-black surfaces.

No. 2694—COAL (sample 28). *Right-hand Fork of Breeding Creek of Clover Fork.* Collected by R. C. B. Thruston. (Splint coal 6 inches, shop coal 26 inches.)

Generally hard, dull-black, breaking into irregular laminæ with but little fibrous coal, and no apparent pyrites.

No. 2695—COAL (sample 29). *Three feet six inches. Elkaner Winn. Branch of Clover Fork. The upper 15 inches is splint coal, showing some pyrites and fibrous coal. The rest is a fat coal, with more pyrites, sometimes in quantity together.* Collected by R. C. B. Thruston.

Generally a pure-looking coal, mostly breaking with bright irregular surfaces, pitch-black. Some portions more dull, breaking into laminæ, with fibrous coal between. Some bright pyrites apparent.

No. 2696—COAL (sample 30). *Low Gap Branch of Child's creek of Clover Fork, 16 feet above sample 20. Sample from the 16 and 3-inch layers in the bed. (So-called shop coal.)* Collected by R. C. B. Thruston.

The bed shows six layers of coal, alternating with seams of shale. Sandstone roof.

No. 2697—COAL (sample 31, page 20). *Head of Laurel Fork of Seagreaves creek of Clover Fork. Two hundred feet above*

fossiliferous limestone. Sample from the upper 70-inch layer. Collected by R. C. B. Thruston.

The bed, with soil roof, has its 70-inch upper layer separated by 26 inches of shale from a lower 6-inch coal seam. Mostly splint coal badly weathered, with some clay intermixed.

No. 2698—COAL (sample 31, page 13). *Low-gap Branch of Child's creek of Clover Fork of Cumberland river. Fifteen feet above sample 20. Sample from the 36-inch seam. Splint coal.* Collected by R. C. B. Thruston.

Bed with five seams of coal, separated by four layers of shale, etc. Sandstone roof. Sample shows but little fibrous coal and no pyrites.

No. 2699—COAL. *Green Jones'*, near mouth of Martin's Fork.

Bed contains two seams of coal, $49\frac{1}{2}$ and 13 inches severally. A pure-looking pitch-black coal, breaking irregularly cuboidal, with irregular shining surfaces. A very little bright pyrites, but no fibrous coal apparent.

COMPOSITION OF HARLAN COUNTY COALS—Continued.
(Air Dried.)

All of these coals are good, and most of them very good, they containing generally but small proportions of ash and sulphur. The best of them are Nos. 2699, 2694, 2691, 2697, 2690, 2695, 2693 and 2692, arranged in the order of their ash percentage.

The relative ash percentage, however, does not always show their exact comparative value as fuel, as may be seen in the following table:

Number.	Ash percentage.	Volatile combustible matters.	Fixed carbon.	Total combustible matters.
2699	2.40	35.72	60.20	95.92
2694	2.90	37.34	57.70	95.04
2691	3.60	33.00	58.90	91.90
2797	4.20	36.10	56.60	92.70
2690	4.40	31.94	61.20	93.14
2695	4.40	37.10	56.70	93.80
2693	5.34	36.80	55.86	92.66
2692	5.86	38.60	53.04	91.64

No. 2692 contains the largest proportion of sulphur, viz.: 1.425 per cent., to be deducted from the total combustible matters; but it also contains the largest proportion of volatile combustible matters, viz.: 38.60 per cent.

Nos. 2696, 2689 and 2698, containing more ash materials than those above tabulated, yet are good fuels, containing large proportions of combustible matters, as shown below.

Number.	Ash percentage.	Volatile combustible matters.	Fixed carbon	Total combustible matters.
2696	10.80	35.00	52.20	87.20
2689	9.40	33.60	55.20	88.80
2698	8.20	34.14	55.50	89.64

The weathered samples, with their large proportions of hygroscopic moisture, of course show smaller proportions of combustible matters than may be found in the same coals deeper in the bed.

HARLAN COUNTY COALS—Concluded.

No. 2700—COAL (sample 33). *Seagreaves creek of Clover Fork.* Sample from the whole 39 inches. Collected by R. C. B.

Thruston. (Considerable pyrites and some fibrous coal low down in the series.)

The sample contains some splint coal, but is mostly coal which breaks irregularly cuboidal, with shining, irregular surfaces, having little or no pyrites or fibrous coal. (The upper 3 inches of the bed is splint coal.)

No. 2701—COAL (sample 34). *Seagreaves creek of Clover Fork of Cumberland river, 400 feet below fossiliferous limestone.* Sample from the 39 inches, the upper layer, 28 inches, being of shop coal; the lower 11 inches, separated from this by 6 inches of indurated clay, is splint coal. Collected by R. C. B. Thruston.

A badly weathered sample, showing some fibrous coal but no pyrites.

No. 2702—COAL (sample 35). *Fugit creek of Clover Fork.* Sample from the main 41-inch layer of the bed. The coal is mainly splint, containing very little fibrous coal or pyrites. Collected by R. C. B. Thruston.

A firm splint or block coal. Some pieces breaking irregularly with shining surfaces.

No. 2703—COAL (sample 36). *Steep Hollow or Coal Branch of Clover Fork, on land of John M. Smith, 16.82 miles above Mount Pleasant.* Sample from the 37-inch cannel coal. Collected by R. C. B. Thruston.

This layer is at the bottom of the bed.

No. 2704—COAL (sample 37). *White Oak Branch of Yocom's creek of Clover Fork.* Sample from the 50-inch layer, which is nearly all shop-coal and hard. Collected by R. C. B. Thruston

Seems to be generally a good firm splint or block coal.

No. 2705—COAL (sample 38). Sample from the 25-inch layer, mainly rich shop-coal. Bottom of the same bed as the next preceding sample. Collected by R. C. B. Thruston.

A good sample of firm semi-cannel or block coal.

No. 2706—COAL (sample 39). *Gray's Branch of Martin's Fork, 5 miles from Mount Pleasant.* Sample from the 28

and 26-inch layers. Fat coking coal, except 3 inches of splint coal at the bottom of the 26-inch layer. Collected by R. C. B. Thruston.

A badly weathered sample. The bed contains four layers of coal separated by seams of shale.

No. 2707—COAL (sample 45). *Frank's Branch of Yocum's creek of Clover Fork. Sample from the 48-inch seam.* Collected by R. C. B. Thruston.

Some fibrous coal, but no pyrites apparent. A somewhat weathered sample.

No. 2708—COAL. *John L. Cornett's, Poor Fork of Cumberland river. Average sample of coal sent for coking.* By R. C. B. Thruston, January, 1886.

A somewhat dull-looking sample of splint coal, breaking into thin irregular laminæ. Some fibrous coal between, but no apparent pyrites.

No. 2709—COAL. *Milton Hensley's. Wallen's creek of Cumberland river. Average sample of the coal tested for coking.* R. C. B. Thruston.

No. 2710—COAL. *S. S. Branson, Clover Lick creek of Poor Fork of Cumberland river. Average sample of coal tested for coking.* R. C. B. Thruston.

COMPOSITION OF HARLAN COUNTY COALS—Concluded.

		(Air Dried.)										
Number in Report.		2700	2701	2702	2703	2704	2705	2706	2707	2708	2709	2710
Hygroscopic moisture		1.52	4.64	1.56	1.74	1.56	2.98	1.44	1.26	2.20	1.30	
Volatile combustible matters		34.88	29.16	36.04	42.64	31.76	35.24	32.02	33.56	29.20	36.70	37.10
Coke		63.60	66.20	63.40	55.80	66.50	63.20	65.00	65.00	69.54	61.10	61.60
Totals		100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
Total volatile matters		36.40	33.80	36.60	44.20	33.50	36.80	35.00	30.46	30.46	38.90	38.40
Fixed carbon		60.70	55.20	60.80	46.48	57.10	58.00	55.30	62.80	56.68	58.86	58.24
Ash		2.90	11.00	2.60	9.32	9.40	5.20	9.70	2.20	12.86	2.24	3.36
Totals		100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
Percentage of sulphur		0.615	0.986	0.835	0.574	0.656	0.931	0.692	0.849	0.848	0.277	1.290
Character of the coke											dense	dense
Color of the ash											spongy.	spongy.
											light	light
											brown.	brown.
											grey.	grey.

Several of these coals, especially those which give small proportions of ash, would yield very good coke, and even those with the largest percentage of ash material would be very good fuel for all ordinary purposes. Calculating their proportions of combustible materials, according to the method used in the table next preceding the above, even No. 2708, with its 12.86 per cent. of ash, contains 85.88 per cent. of combustible matters, including its 0.848 per cent. of sulphur, and No. 2706, with its 9.70 per cent. of ash, contains 87.32 per cent. of combustible matters, including 0.692 per cent. of sulphur. This, as well as Nos. 2701 and 2709, are weathered samples, and No. 2703 is a cannel coal, as is indicated by its large percentage of volatile combustible matters.

The very best of these coals are Nos. 2707, 2709, 2702 and 2700, arranged in the order of their ash percentage, the first having only 2.20 and the last named 2.90 per cent. These contain from 96.36 in No. 2707 to 95.58 per cent. in No. 2700 of total combustible matters. The others fall in between these two extremes.

HARLAN COUNTY COKES.

No. 2711—COKE (No. 11). *Made of Wallen's creek coal, Harlan county, Ky. Forty-eight hour coke made at Quinimont, West Virginia, March 22 and 24, 1886. R. C. B. Thruston.*

No. 2712—COKE (No. 10). *Made from coal of John L. Corbett, Island Branch of Poor Fork, Harlan county. Seventy-two hour coke made at Quinimont, West Virginia, March 20-23, 1886. R. C. B. Thruston.*

No. 2713—COKE (No. 9). *Made from coal of S. S. Branson, Clover Lick creek of Poor Fork, of Cumberland river, Harlan county. Seventy-two hour coke, made at Quinimont, West Virginia, March 20-23, 1886. R. C. B. Thruston.*

No. 2714 (No. 11). *Made of Wallen's creek coal. Harlan county. Seventy-two hour coke, made at Quinimont, West Virginia, March 20-23, 1886. R. C. B. Thruston.*

COMPOSITION OF THESE HARLAN COUNTY COKES. (Air Dried.)

Number in Report.	2711	2712	2713	2714
Moisture, etc., expelled at red heat	0.60	1.34	0.40	0.90
Fixed carbon	93.10	80.76	93.60	92.90
Ash	6.30	17.90	6.00	6.20
Totals.	100.00	100.00	100.00	100.00
Percentage of sulphur	0.546	0.648	1.068	0.368
Color of the ash	brownish grey.	light grey.	light grey brown.	grey brown
Hours of coking	48	72	72	72

With the exception of No. 2712, which contains too much ash material, these have the composition of very good cokes.

Their degree of porosity, or their power to resist pressure, were not tested, but they all appear to be good firm, dense cokes. It is a fact, however, known to most manufacturers of coke, that its density or porosity depends somewhat on the pressure which is applied to it in the oven when in its soft condition in the act of coking.

Hence, the lower portion of a bed of coke, which has been measurably coked by the heat of the oven before much weight of coal is applied, is generally more porous and spongy than that which is subsequently formed under the load of the full charge of coal. No doubt different coals, under similar conditions, will give cokes of very different degrees of density, and possibly, also, the length of time given to the process, and the mode of application of the heat, whether gradual or sudden, may affect the porosity and density of the coke.

HICKMAN COUNTY.

CLAYS.

No. 2715—FIRE-CLAY. *Bluff above Columbus, sixty-five feet above low water. Below gravel. Collected by John R. Procter.*

A fine sandy clay, of a light grey color. Infusible before the blow pipe.

COMPOSITION.—(Air Dried.)

Silica	85.180
Alumina	10.260
Iron peroxide	1.120
Lime	trace.
Magnesia . . . . .	.064
Potash . . . . .	.954
Soda . . . . .	.146
Water, etc.	2.276
	100.000
Fine sand (per cent.)	70.100

This so-called clay owes its plastic properties to the state of very fine division of the large quantity of siliceous sand which it contains, its 10.260 per cent. of alumina being equivalent to only 25.920 per cent. of kaolin, the basis of true clay.

It appears to be quite refractory in the fire, notwithstanding its nearly one per cent. of potash. No doubt it could find profitable applications; in the ceramic art; as a scouring material; in glass manufacture; or for fire-proof linings, etc.

No. 2715 (a). RED OCHREOUS CLAY. *Below gravel. Columbus Bluff.* Collected by John R. Procter.

Of a dull pink color. Calcines of a purplish-brown color. Quite plastic. Washed in water it yielded 36.69 per cent. of fine sand.

It owes its color to hydrated peroxide of iron, like the ochres described under Ballard and Calloway counties, Nos. 2572 and 2651 (which see). It could no doubt be used as a cheap pigment (after washing it), either in its raw state or after calcination, or applied in terra-cotta works.

JEFFERSON COUNTY SOIL.

No. 2716—SOIL (Surface). Collected by George Crum *from a farm near Louisville. Characterized as a mucky soil, which fails to produce crops.* Appears to belong to the Devonian black shale formation. The sample was sent to Prof. M. A. Scovell, Director of Agricultural Experiment Station (No. 25), at the State College of Kentucky, for analysis.

When received in a bottle it was wet and plastic like clay, but it dried readily when exposed in a dry atmosphere. The dried soil is of dirty drab color. Clods friable.

All passed through the coarse sieve except 5.7 per cent. of shot-iron ore. Dried at 212° F., it lost only 1.7 per cent. of hygroscopic moisture.

COMPOSITION.—(Dried at 212° F.)

	Per cent.
Organic and volatile matters	5.100
Alumina	10.524
Iron peroxide	3.795
Carbonate of lime . . . . .	.140
Magnesia . . . . .	.458
Phosphoric acid ($P_2 O_5$) . . . . .	.176
Potash extracted by acids . . . . .	.191
Soda extracted by acids . . . . .	.201
Water expelled at 380° F	1.000
Fine sand and insoluble silicates	78.950
	100.535
Hygroscopic moisture	1.700
Potash in the siliceous residue	1.855
Soda in the siliceous residue . . . . .	.229

The chemical composition of this soil is such as characterizes productive soils generally, with the exception that the alumina is in large proportion, and the lime somewhat below a good average; but its physical condition, causing it to be quite plastic and adhesive when wet, and no doubt its local position, where it is subjected to an excess of water, are unfavorable to productiveness.

Thorough draining to carry off the excess of water, and the free use of lime, would very probably make it productive.

JOHNSON COUNTY.

COALS.

No. 2717—COAL. *Walter Fletcher's, Little Paint creek. Cannel coal, from the upper twenty-two inches of the forty-three inch bed. Sample taken from the specimen at the Exposition.** By R. C. B. Thruston. Collected by G. M. Hodge.

*At New Orleans.

A pure-looking cannel coal. No apparent pyrites or fibrous coal.

No. 2718—COAL from same bed. Sample of the lower twenty-one inches. Bituminous or splint coal. By R. C. B. Thruston. Collected by G. M. Hodge.

A very pure-looking coal.

COMPOSITION OF THESE COALS.—(Air Dried.)

Number in Report.	2717	2718
Specific gravity	1.242	1.275
Hygroscopic moisture	1.44	2.56
Volatile combustible matters	50.22	39.94
Coke	48.34	57.50
Totals	100.00	100.00
Total volatile matters	51.66	42.50
Fixed carbon in the coke	40.74	54.10
Ash	7.60	3.40
Totals	100.00	100.00
Percentage of sulphur	0.837	1.030
Character of the coke	dense.	spongy.
Color of the ash	light buff.	light buff.

Both very good coals. The cannel coal is distinguished by its larger proportions of volatile combustible matters and ash, as well as by its lower specific gravity, notwithstanding its much larger ash percentage.

KNOTT COUNTY COALS.

No. 2719—COAL on John Amburgy's land, Wolf Run Branch of Amburgy's Branch of Carr Fork of Kentucky river. Sampled for analysis from the specimen at the New Orleans Exposition (1885) by R. C. B. Thruston. Collected by G. M. Hodge. The upper portion of the bed bituminous coal. Apparently a much weathered sample. Friable, and soiled with earthy matter, which will increase its moisture, etc.

No. 2720—COAL of the same bed, etc., the lower twenty-five inches. Cannel coal, etc.

A pure-looking cannel coal.

COMPOSITION OF THESE KNOTT COUNTY COALS.

(Air Dried.)

Number in Report.	2719	2720
Specific gravity	1.355	1.206
Hygroscopic moisture	6.48	0.72
Volatile combustible matters	29.78	44.40
Coke	63.74	54.88
Totals	100.00	100.00
Total volatile matters	36.26	45.12
Fixed carbon in the coke	60.64	47.00
Ash	3.10	7.88
Totals	100.00	100.00
Percentage of sulphur	0.598	0.753
Character of the coke	pulverulent.	dense.
Color of the ash	salmon colored.	light buff.

Very good coals, exemplifying the distinctive characters of cannel and bituminous coals, with this qualification, that the bituminous coal, having been much more altered by "weathering" than the cannel coal, contains much more hygroscopic moisture, and gives a pulverulent coke instead of a spongy one, which it would no doubt yield if in the unweathered condition. Deeper in the bed, this layer of the coal would probably be found much better in quality.

KNOX COUNTY COALS.—Continued.

No. 2721—COAL. Noah Wiggins', Fighting creek of Cumberland river. Average sample from the coal sent for coking. Collected by R. C. B. Thruston.

A bright splint coal, breaking with irregular shining surfaces. Some fibrous coal between the irregular laminæ.

No. 2722—COAL. Sandy Branch, near Flat Lick. A sample of the coal sent for coking. Collected two years ago. R. C. B. Thruston.

CHEMICAL REPORT.

No. 2723—COAL. *O. P. Ely's, Flat Lick.* Average sample of the coal collected two years ago. Collected by R. C. B. Thruston.

No. 2724—COAL. *Pursifull seam, near Flat Lick.* Average sample of coal collected two years ago. R. C. B. Thruston.

COMPOSITION OF THESE KNOX COUNTY COALS.

(Air Dried.)

Number in Report.	2721	2722	2723	2724
Hygroscopic moisture	1.20	1.80	2.00	1.20
Volatile combustible matters	38.80	36.60	35.30	35.08
Coke	60.00	61.60	62.70	63.72
Totals	100.00	100.00	100.00	100.00
Total volatile matters	40.00	38.40	37.30	36.28
Fixed carbon in the coke	58.86	58.12	61.90	58.92
Ash	1.14	3.48	0.80	4.80
Totals	100.00	100.00	100.00	100.00
Percentage of sulphur	0.615	0.884	0.766	0.766
Character of the coke	spongy.	spongy.	dense spongy.	light spongy.
Color of the ash	dark salmon col'd.	lt. brown grey.	light brown.	very light brown.

These are all remarkably good coals, which would yield good cokes. The exceptional small ash percentage of No. 2723 was verified by repetition with the same sample.

KNOX COUNTY COKES.

No. 2725—COKE from *Noah Wiggins' coal, Fighting creek, Cumberland river.* Seventy-two hours' coke. Made at Quinimont, West Virginia. R. C. B. Thruston.

No. 2726—COKE from *coal of Sandy Branch, near Flat Lick.* A forty-eight hour coke. Made at Quinimont, West Virginia. R. C. B. Thruston.

No. 2727—COKE from *O. P. Ely's coal, Flat Lick.* Seventy-two hours' coke. Made at Quinimont. R. C. B. Thruston.

CHEMICAL REPORT.

No. 2728—COKE from *coal of Pursifull seam, near Flat Lick.* Seventy-two hour coke. Made at Quinimont. R. C. B. Thruston.

COMPOSITION OF THESE KNOX COUNTY COKES.

(Air Dried.)

Number in Report.	2725	2726	2727	2728
Moisture, etc.	0.90	0.40	0.50	0.90
Fixed carbon.	95.90	93.70	96.00	90.70
Ash	3.20	5.90	3.50	8.40
Totals	100.00	100.00	100.00	100.00
Percentage of sulphur.	0.546	0.478	0.217	0.546
Color of the ash	reddish brown.	brownish grey.	brown.	brownish grey.

These are all remarkably good cokes, so far as chemical composition can determine.

LAUREL COUNTY COALS.

No. 2729—CANNEL COAL of *Frederick Wiedmer, one mile from London, Laurel county.* Sample brought to the laboratory by John R. Procter.

Somewhat laminated. Portions resembling bituminous shale. Showing some minute specks of mica.

No. 2730—COAL of *the Pitman Coal Company, Pittsburg, Laurel county.* Sample from the coal selected two years ago for coking. By R. C. B. Thruston.

GEOL. SUR.—5.

COMPOSITION OF THESE LAUREL COUNTY COALS.
(Air Dried.)

Number in Report.	2729	2730
Hygroscopic moisture	0.60	2.56
Volatile combustible matters	31.66	34.56
Coke	67.74	62.88
Totals	100.00	100.00
Total volatile matters	32.26	37.12
Fixed carbon in the coke	45.24	59.58
Ash	22.50	3.30
Totals	100.00	100.00
Percentage of sulphur	not est.	0.895
Character of the coke	dense.	spongy.
Color of the ash	{ dark pur- plish-grey.	light grey.

No. 2730 is a very good, rich coal, well suited for the manufacture of coke, as the report below demonstrates.

No. 2729 may answer well for fuel in its own vicinity, but its high ash percentage might preclude distant transportation.

No. 2730a—COKE of the Pitman Coal Company's coal (No. 2730). *Seventy-two hour coke.* Made at Quinnimont, West Virginia, March 20-27, 1886. R. C. B. Thruston.

COMPOSITION. (Air Dried.)

Moisture, etc., expelled at red heat	0.50
Fixed carbon	92.60
Brownish-grey ash	6.90
	100.00
Percentage of sulphur	0.615

This appears to be a very good coke. Much of the sulphur of the coal was burnt out in coking.

LAWRENCE COUNTY.

PETROLEUM.

No. 2731—PETROLEUM from the F. F. well, on Blain creek, land of the Vinson Oil Company, Lawrence county. Sample sent by John R. Procter. (Received January 9, 1885.)

A thick petroleum, of the consistence of molasses; of a brown color, from admixture of earthy matters, colored with iron peroxide and water, of which some separates on standing. It is an emulsion of dense petroleum with water containing earthy matters, colored with ferric oxide.

It was submitted to fractional distillation with following results:

Kerosene oil (so-called)	14.31	{ Specific gravity, C 795 to 0.836, boiling from 338° to 530° F.
Mineral sperm oil (so-called)	2.18	{ Specific gravity, .849; boiling point 520° to 580°.
Lubricating oil (so-called)	1.45	{ Specific gravity, not est.; boiling point, 580° to 600°.
Water	31.81	
Denser oils and sediment	50.25	
	100.00	

The distillation was not completed because of the breaking of the flask and the limited quantity of the sample.

No. 2732—PETROLEUM from Lower Laurel well, 320 to 330 feet deep. *Yields about 100 gallons per day.* Well No. 1, on Lower Laurel creek, about 1 mile from the mouth of the creek. Sample sent to Prof. Crandall by W. R. M. Broas, of Ashland, November 15, 1885.

A brownish-black, rather thick fluid, of specific gravity 0.853, containing very little water.

It was submitted to distillation in an iron retort until 91.4 per cent. had passed over. This, called the *first distillate*, was submitted to fractional distillation, with results stated below, under the head *second distillation*. The residue in the iron retort, of specific gravity 0.860, is noted there as No. 7, or *first distillate*.

This *first distillate*, submitted to *second distillation*, gave the following products:

	Specific gravity.
No. 1. Distilling below 266° F.	= to 11.2 p. c. of the crude petroleum = 0.724
No. 2. Distilling from 266° to 320° F.	= to 5.1 p. c. of the crude petroleum = 0.755
No. 3. Distilling from 320° to 428° F.	= to 14.4 p. c. of the crude petroleum = 0.786
No. 4. Distilling from 428° to 518° F.	= to 13.8 p. c. of the crude petroleum = 0.817
No. 5. Distilling from 518° to 608° F.	= to 10.8 p. c. of the crude petroleum = 0.840
No. 6. Distilling from above 608° F.	= to 15.7 p. c. of the crude petroleum = 0.855
No. 7. Product of the first distillation in iron retort	= to 19.6 p. c. of the crude petroleum = 0.860
Coke	3.3
Gas, water and loss	6.1
	100.0

These products would fall nearly under the following commercial heads, viz:

- No. 1. Mostly Gasoline and Naphtha.
- No. 2. A. Naphtha.
- No. 3. Kerosene, or so-called coal-oil.
- No. 4. Mineral sperm oil.
- No. 5. Fine lubricating oil; spindle oil.
- No. 6 and 7. Paraffine oils, from which heavy lubricating oils and solid paraffine may be obtained.

LESLIE COUNTY.

COALS.

No. 2733—COAL. *McClellan Schell's.* Bed 73 inches thick. *Upper Double Branch of Greasy creek.* Collected by G. M. Hodge.

A weathered and somewhat soiled sample of what seems to be a good coal.

No. 2734—COAL. *Nicholas Schell's.* Bed 64 inches thick. *Upper Double Branch of Greasy creek.* Collected by G. M. Hodge.

Seems to be a splint coal. Sample somewhat weathered. Some little fibrous coal, but no pyrites apparent.

No. 2735—COAL. Bed 44 inches thick. *Lewis' Branch of Greasy creek.* The lower 7 inches was not sampled. Collected by G. M. Hodge.

A somewhat weathered sample of what seems to be a good splint coal.

No. 2736—COAL. Bed 83 inches thick. *Head of Pace Trace, White Oak creek.* Sample from the lower 53 inches. Collected by G. M. Hodge.

A weathered sample of what seems to be a good splint coal.

No. 2737—COAL. Bed 69 inches thick. *William Sisemore's, Rockhouse creek.* The bottom 6 inches not sampled. Collected by G. M. Hodge.

A pure-looking, firm coal, generally breaking irregularly, with irregular shining surfaces. A portion with lamellar fracture, and some fibrous coal; no pyrites apparent.

No. 2738—COAL. *Jesse Morgan's.* Sixty-five inches thick. *On Middle Fork.* Collected by G. M. Hodge.

Resembles the next preceding. Seems to have more splint coal.

No. 2739—CANNEL COAL. *Jerry Ledington's.* Thirty-eight inches thick. *Beech Fork, mouth of Oldham Branch.* Collected by G. M. Hodge.

No. 2740—COAL. Sixty-one inches thick. *Wesley McFadden's.* *Big creek.* *Red Bird creek.* Collected by G. M. Hodge.

No pyrites apparent, and but little fibrous coal.

No. 2741—COAL. Bed 57 inches thick. *Richard Collins' Hal's Fork.* *Big creek.* *Red Bird creek.* Collected by G. M. Hodge.

No apparent pyrites, and but little fibrous coal.

No. 2742—COAL. Bed 53 inches thick. *Asper's Bank, Middle Fork of Kentucky river, two miles below Hyden.* Collected by G. M. Hodge.

Some fibrous coal between the laminæ, but no apparent pyrites.

No. 2743—COAL. Bed 46 inches thick. *Silas Nantz's, Oldhouse Branch, Beech Fork, Middle Fork of Kentucky river.* Collected by G. M. Hodge.

Seems to be somewhat weathered. Ferruginous incrustation on some pieces. Some fibrous coal apparent, but no pyrites.

CHEMICAL REPORT.

Number in Report.	2733	2734	2735	2736	2737	2738	2739	2740	2741	2742	2743	
Specific gravity	1.342	1.363	1.251	1.509	1.279	1.291	not est.	1.322	1.285	1.321	1.502	
Hygrometric moisture	3.20	1.72	1.72	9.40	0.74	0.70	1.10	1.60	1.40	1.80	1.30	
Volatile combustible matters	29.70	35.68	35.02	32.20	36.06	34.70	44.20	34.94	35.68	34.14	32.36	
Coke	67.10	62.60	63.26	58.40	63.20	64.60	54.70	63.46	62.92	64.06	66.34	
Totals	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	
Total volatile matters	32.90	37.40	36.74	41.60	36.80	35.40	45.30	36.54	37.08	35.94	33.66	
Fixed carbon in the coke	57.50	51.20	57.60	48.80	54.00	55.20	43.70	55.46	58.92	57.86	50.34	
Ash	9.60	11.40	5.66	9.60	9.20	9.40	11.00	8.00	4.00	6.20	16.00	
Totals	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	
Percentage of sulphur	0.626	1.367	0.599	0.433	1.307	0.983	0.690	1.066	0.667	0.613	1.409	
Character of the coke	{ dense.		{ light spongy.		{ spongy.		{ dense.		{ spongy.		{ dense.	
Color of the ash.	{ lt. brn'h		{ lt. pur'h		{ lt. brn'h		{ lt. grey-		{ lt. red h		{ lt. lilac-	
	{ grey.		{ grey.		{ grey.		{ brown.		{ grey.		{ grey.	

CHEMICAL REPORT.

Except Nos. 2741, 2735 and 2742, these Leslie county coals contain more than a good average proportion of ash material, these three, the best of all, giving, severally, only 4.00, 5.66 and 6.20 per cent. of ash; contain, severally, 94.60, 92.62 and 92.00 per cent. of total combustible matters, including small proportions of sulphur. The ash proportion in the other eight coals varies from 8 per cent. in No. 2740 up to 16 per cent. in No. 2743. By adding together the volatile combustible matters and fixed carbon in the coke, it will be seen that the total combustible matters in these eight coals varies from 81.00 in No. 2736 to 90.40 per cent. in No. 2740. So that the worst of all contains 81 per cent. of combustible matters, including 0.433 per cent of sulphur. It may be stated, however, that the sample of this particular coal was from the very much weathered outcrop of the bed, and contained as much as 9.40 per cent. of moisture, and that this, as well as the other coals which had been weathered, will be found much better taken deeper in the bed.

It will be noticed that those coals which have the greatest proportions of ash materials have also the largest percentage of sulphur, generally speaking. The cannel coal No. 2739 is to be distinguished by its largest proportion of volatile combustible matters. Coals with large proportions of ash material are not available for the manufacture of good coke; but cannel coals, although containing large proportions of ash materials, may yet be available in gas manufacture because of their large proportions of volatile combustible matters.

LETCHER COUNTY.

COALS.

No. 2744—COAL. *Right Hand Branch of Right Hand Fork of Collier's creek, 4 miles above its mouth. Two hundred and sixty feet above a limestone. Forty-one inches of coal on 2 inches of cannel shale.* Collected by R. C. B. Thruston. A badly weathered outcrop sample; a somewhat mixed splint coal.

No. 2745—COAL. *Wilson Lewis', Roland's Branch of Poor Fork of Cumberland river. Average sample collected for coking.* By R. C. B. Thruston.

CHEMICAL REPORT.

COMPOSITION OF THESE LETCHER COUNTY COALS.

(Air Dried.)

Number in Report.	2744	2745
Hygroscopic moisture	2.40	1.40
Volatile combustible matters	32.60	33.40
Coke	65.00	65.20
Totals	100.00	100.00
Total volatile matters	35.00	34.80
Fixed carbon in the coke	62.44	59.08
Ash	2.56	6.12
Totals	100.00	100.00
Percentage of sulphur	0.492	1.426
Character of the coke	{ dense friable.	spongy.
Color of the ash	{ lt. salmon-colored.	light grey.

Both good coals. The weathered sample does not probably represent the entire character of the coal deeper in the bed, where it would contain less hygroscopic moisture and more sulphur. The analysis of the coke made from coal No. 2745 is given below.

No. 2746—COKE (No. 22). From Wilson Lewis' coal (No. 2745), Roland's Branch of Poor Fork. Seventy-two hour coke. Made at Quinnimont, West Virginia. R. C. B. Thruston.

COMPOSITION. (Air Dried.)

Moisture expelled at red heat	0.70
Fixed carbon	89.30
Light grey-brown ash	10.00
	100.00
Percentage of sulphur	0.863

The percentage of ash is somewhat above good average, but not excessive.

CHEMICAL REPORT.

MARSHALL COUNTY.

SOILS.

No. 2747—VIRGIN SOIL of Crawfish Flats of Tennessee River Valley, 2 miles below the mouth of Jonathan creek. Sample taken to the depth of 8 inches. Growth: hickory and red and post oaks and sassafras. Collected by R. H. Loughridge.

Dried soil in friable clods of a dirty light grey-buff color, with dark infiltrations. The coarse sieve* separated from it about 8.2 per cent. of fine shot-iron ore. Its siliceous residue, from digestion in acids, all passed through the fine sieve† except 0.15 per cent. of fine hyaline sand.

No. 2748—SUBSOIL of the next preceding soil, etc.

Color somewhat lighter than that. Clods firmer. All passed through the coarse sieve except about 3.9 per cent. of shot-iron ore. Its siliceous residue passed through the fine sieve, except 3.15 per cent. of fine white sand.

No. 2749—VIRGIN SOIL from bottom land of East Fork of Clark's river, near Benton. Sample taken 10 inches deep. Growth: mostly white oak. Soil: crawfishy. Collected by R. H. Loughridge.

The dried soil, in friable clods, is of a dark buff-grey color. The coarse sieve separated from it about 5.8 per cent. of shot-iron ore. Its siliceous residue left 3.725 per cent. of fine white sand on the fine sieve.

No. 2750—VIRGIN SOIL of Post Oak Flats of Clark's river, north of Stringtown. Sample taken to the depth of 12 inches. Crawfishy in character. Growth: post oak chiefly.

The coarse sieve removed from it about 4 per cent of shot-iron ore. Its siliceous residue left 1.05 per cent. of fine white sand on the fine sieve.

No. 2751—VIRGIN SOIL. Dark sandy loam from low ridge of Tennessee River Valley, 2 miles below the mouth of Jonathan creek. Sample taken to the depth of 12 inches.

*Coarse sieve has 64 meshes to the centimeter square.

†Fine sieve has 1600 meshes to the centimeter square.

Growth: white and Spanish oaks and dogwood. Collected by R. H. Loughridge.

Dried soil in moderately firm clods of a light grey-brown color. All passed through the coarse sieve except about 0.4 per cent. of shot-iron ore. The fine sieve separated from its siliceous residue 1.5 per cent. of fine white sand.

No. 2752—*VIRGIN, CRAWFISHY OR GLADY SOIL of Tennessee Valley, 1 mile north of Calvert City.* Sample taken to the depth of 10 inches. Collected by R. H. Loughridge.

Dried soil, in pretty firm clods, of a grey-buff color. All passed through the coarse sieve except small fragments of sassafras roots and a little shot-iron ore. The fine sieve removed from its siliceous residue 1.825 per cent. of fine white sand.

No. 2753—*VIRGIN LOAM SOIL of low ridge of Tennessee River Valley, 1 mile north of Birmingham.* Sample taken to the depth of 12 inches. *Growth: oak and sassafras.* Collected by R. H. Loughridge.

Dried soil, in moderately firm clods, of a light grey-brown color. All passed through the coarse sieve except a small angular fragment of red jasper and a few grains of shot-iron ore. Only a few grains of fine sand were separated from the siliceous residue by the fine sieve.

No. 2754—*FLATWOOD VIRGIN SOIL, four miles south-west of Benton, on the Harvey road.* Sample taken to the depth of 8 inches. *Growth: red and white oaks, hickory and sassafras.* Collected by R. H. Loughridge.

Dried soil, with friable clods, of a light grey-brown color. All passed through the coarse sieve except a very small quantity of shot-iron ore and vegetable debris. Insoluble silicates all passed through the fine sieve.

No. 2755—*SUBSOIL of the next preceding.* Sample taken at the depth of from 8 to 14 inches. Collected by R. H. Loughridge.

Dried soil in moderately firm clods, of a light grey-brown color. All passed through the coarse sieve. Its siliceous residue all passed through the fine sieve.

No. 2756—*WHITE SILTY SOIL. Middle Fork of Clark's river. Quaternary.* Collected by R. H. Loughridge.

Dried soil of a light grey-buff color. All passed through the coarse sieve except about 0.44 per cent. of shot-iron ore and ferruginous sandstone. The fine sieve separated only a very small quantity of fine white sand from its siliceous residue.

No. 2757—*BOTTOM SOIL of West Fork of Clark's river, near Brewer's old mill.* Sample taken to the depth of 10 inches. *Growth: exclusively beech.* Rich yellow loam soil. Collected by R. H. Loughridge.

Dried soil of a grey-brown color. Clods moderately firm. All passed through the coarse sieve except a very small quantity of shot-iron ore.

COMPOSITION OF THESE MARSHALL COUNTY SOILS.
(Calculated Dried at 212° F.)

76

Number in Report.	2747	2748	2749	2750	2751	2752	2753	2754	2755	2756	2757
Organic and volatile matters	3.443	2.373	3.757	3.845	3.467	3.506	4.411	2.949	2.330	2.129	3.394
Alumina and manganese oxide	3.303	5.021	3.706	4.623	4.875	3.030	4.448	3.671	4.087	3.875	3.248
Iron peroxide	1.955	2.630	1.360	3.039	2.332	2.037	3.395	2.077	2.667	2.930	1.764
Lime carbonate	.025	trace.	.026	.076	.046	trace.	.046	.046	.046	.046	.146
Magnesia	.162	.139	.143	.181	.194	.281	.344	.226	.327	.309	.180
Phosphoric acid (P_2O_5)	.136	.110	.109	.127	.113	.110	.094	.046	.014	not est.	.084
Potash extracted by acids	.047	.515	.083	.477	.192	.305	.160	.117	.079	.179	.172
Soda extracted by acids	.607	.227	.210	.084	not est.	.046	not est.	.048	not est.	not est.	not est.
Water expelled at 380° F.	90.217	88.877	90.070	87.057	.531	.509	.557	.974	.794	.841	1.028
Sand and insoluble silicates					88.460	89.643	86.678	89.452	89.453	88.884	89.757
Totals	99.895	99.892	100.047	99.733	100.210	99.467	100.087	99.558	99.795	99.192	99.773
Hygroscopic moisture	1.300	1.100	1.520	1.800	1.225	1.900	1.400	1.300	1.300	1.850	1.300
Potash in siliceous residue	1.544	0.515	1.438	1.284	1.600	1.506	1.614	1.434	1.462	1.631	.323
Soda in siliceous residue	1.418	.153	.402	.526	.398	.312	.598	.542	.430	.636	.017
Sand	3.150	0.150	3.725	1.050	1.500	1.825	trace.	0	0	0	.098
Character of the soil	Virgin.	Subsoil.	Virgin.	Virgin.	Virgin.	Virgin.	Virgin.	Virgin.	Subsoil.	Silty.	Bottom.

CHEMICAL REPORT.

CHEMICAL REPORT.

77

All of these Marshall county soils are very deficient in lime except No. 2757, which contains only 0.146 per cent., which may be considered rather below a good average proportion. They would no doubt all be benefited by top-dressings of lime. Several of them only gave mere traces of this essential element of vegetable food.

Potash is deficient in Nos. 2747, 2749 and 2755, but is in quantity above a good average in Nos. 2748, 2750 and 2752, and in good average proportions in the rest of the soils.

Phosphoric acid is somewhat below average proportions in Nos. 2753 and 2757, and very deficient in Nos. 2754 and 2755.

All these deficiencies could be supplied by the application of appropriate commercial fertilizers or otherwise, and then even the worst of these soils could be made and kept fertile, with good husbandry, if they are sufficiently drained; they being all light and porous, made up of very finely divided earthy materials, without any coarse sand or gravel.

No. 2758—WHITE SAND. *Cretaceous. North bank of Clark's river, 2 miles north of Benton, Marshall county.* Collected by R. H. Loughridge.

A fine-grained sand; white, with a slight tinge of yellowish. Contains small mica specks. It all passed through the coarse sieve. Its insoluble residue, after digestion in acids, is mostly fine white hyaline quartz sand, containing some small mica scales.

COMPOSITION OF THIS MARSHALL COUNTY SAND.

(Calculated Dried at 212° F.)

Organic and volatile matters	0.395
Alumina, iron oxide, etc.	.323
Lime carbonate	a trace.
Magnesia	.017
Phosphoric acid (P_2O_5)	.098
Potash extracted by acids	.189
Soda extracted by acids	
Water expelled at 400° F.	.051
Sand, etc.	98.989
	100.057
Hygroscopic moisture	0.050
Potash in siliceous residue	.001
Soda in siliceous residue	.001

This sand might be made useful in glass-making and in tempering tough clays for refractory pottery or fire-bricks.

MARSHALL COUNTY.

CLAYS.

No. 2759—CLAY. *Burradell's. Five miles north of Benton.*
Collected by R. H. Loughridge.

Dried clay of a light grey color. Sandy. Infusible before the blow-pipe. Calcines hard. Washed in water left 70.33 per cent. of fine whitish sand, containing small mica scales.

No. 2760—CLAY *from Gray's place, near Scale, Marshall county.* Collected by R. H. Loughridge.

A whitish clay, with a little yellow ochre in spots and layers. Before the blow-pipe it fused light-colored. Contains no sand.

No. 2761—ASH-COLORED EARTH *from a cistern on the old Winter's place, 8 miles south-east of Olive Post-office.* (Of what value is it?) Collected by R. H. Loughridge.

Nearly white. Infusible before the blow-pipe. Calcines white and hard. Washed in water, left about 33.7 per cent. of light grey sand.

No. 2762—CLAY. *Banks of Tennessee river, at Highland. Geological position, Port Hudson.* Collected by R. H. Loughridge.

Of a light grey-brown color. Contains some small blue specks (iron phosphide), scantily diffused. Fuses before the blow-pipe. A similar clay, with blue particles of iron phosphide (*Vivianite*), is described under McCracken county, No. 2781, which gave decided reaction of phosphoric acid.

No. 2763—PIPE-CLAY. *J. T. Pugh's place, 2 miles east of Palma. Tertiary formation.* Collected by R. H. Loughridge.

Of very light brownish-grey color. Contains minute mica specks. Before the blow-pipe it fuses with great difficulty.

No. 2764—DECOMPOSING WHITE CHERT *of siliceous Subcarboniferous limestone, 4 miles west of Birmingham, on Mrs. Lou. Stone's place.* Collected by R. H. Loughridge.

COMPOSITION OF THESE MARSHALL COUNTY CLAYS.

(Air Dried.)

Number in Report,	2759	2760	2761	2762	2763	2764
Silica	84 580	52.580	91.580	60.980	62 920	93.700
Alumina	10 650	31.070	5.980	18.480	29.880	3.580
Iron peroxide	330	1.510	.220	7.500		trace.
Lime. . . . .	.187	.187	.045	.780	trace.	trace.
Magnesia . . . . .	.101	.245	.055	1.128	.209	.127
Potash . . . . .	.954	1.775	.094	2.264	1.564	.618
Soda . . . . .	.292	.318	.032	.627	.172	.117
Water, etc.	2 956	12.365	1.994	7.841	5.255	1.858
Totals	100 000	100.000	100.000	100.000	100.000	100 000
Sand	70.330	0	33.700	not est.	not est.	0

These clays are all quite refractory, except No. 2762, which melts comparatively easy before the blow-pipe, and No. 2760, which fuses with difficulty. This latter clay would serve for the manufacture of white pottery ware. The first named could be used for colored terra cotta, etc. No. 2763 is quite a refractory white clay, and Nos. 2761 and 2764, the latter designated as decomposing chert or horn stone, and the former being of a similar origin probably, are both remarkable because of their very large proportions of silica, which is so very finely divided that they possess the plastic property of clay, and calcine hard. They could probably be utilized as scouring materials, in the form called Bath bricks, or otherwise. They are very refractory. They are more properly designated siliceous earths than clays.

MARTIN COUNTY.

COALS.

No. 2765—COAL. *Head of Seafford's Lick Branch of Rockcastle creek, on land of the Rockcastle Mining and Lumber Company. Sampled for analysis by R. C. B. Thruston from the section of the bed exhibited at the New Orleans Exposition. Collected by G. M. Hodge from above the 26-inch parting.*

A somewhat weathered sample of pure-looking splint coal.

No. 2766—COAL from the same bed section. Collected by G. M. Hodge. Sampled from the part below the 26-inch parting. By R. C. B. Thruston.

Apparently more weathered than the preceding. Splint coal, showing fibrous coal, but no apparent pyrites, between its thin laminæ. Much of the sample is in a pulverulent condition.

COMPOSITION OF THESE MARTIN COUNTY COALS.

(Air Dried.)

Number in Report.	2765	2766
Specific gravity	1.344	1.451
Hygroscopic moisture	2.92	2.62
Volatile combustible matters	34.98	27.98
Coke	62.10	69.40
Totals	100.00	100.00
Total volatile matters	37.90	30.60
Fixed carbon in the coke	55.30	50.40
Ash	6.80	19.00
Totals	100.00	100.00
Percentage of sulphur	0.681	0.736
Character of the coke	{ dense spongy. light buff.	friable. light grey.
Color of the ash		

The coal of the upper portion, with its 6.80 per cent. of ash, contains 90.28 per cent. of combustible matters, including its sulphur, while that of the lower seam contains only 78.38 per cent., with its 19 per cent. of ash. This latter coal would not bear long transportation. Both samples seem to show weathering, and it is probable that deeper in the bed the coal will be found to be somewhat purer.

MCCRACKEN COUNTY.

SOILS.

No. 2767—SOIL (virgin). *Oak and Hickory Flatlands.* Albert. Bradshaw's land, south-west of Paducah. Sample taken to

the depth of 8 inches. Timber: white and red oaks, hickory, dogwood and sassafras. Collected by R. H. Loughridge.

Dried soil of a brownish-grey color. Clods friable. All passed through the coarse sieve* except a small quantity of vegetable debris. Its siliceous residue, from digestion in acids, all passed through the fine sieve† except a very small quantity of very fine hyaline sand.

No. 2768—SUBSOIL of the next preceding. Sample taken at the depth of 8 to 15 inches. Collected by R. H. Loughridge.

Dried subsoil of a lighter color than the surface soil, and more yellowish. Its small clods were firm. All passed through the coarse sieve except a small quantity of vegetable debris. Its siliceous residue passed through the fine sieve except 2.75 per cent. of fine white quartz sand.

No. 2769—VIRGIN SOIL. *Brown loam. New Hope Church. South-west corner of McCracken county.* Sample taken to the depth of 6 inches. Timber: white and red oaks, hickory, dogwood and sassafras. Collected by R. H. Loughridge.

Dried soil of a light grey-brown color. Clods friable. All passed the coarse sieve* except a small portion of vegetable debris. Its siliceous residue, from digestion in acids, all passed through the fine sieve† except a few small grains of hyaline quartz sand.

No. 2770—SUBSOIL of the next preceding. Taken at the depth of from 6 to 12 inches. Collected by R. H. Loughridge.

Dried subsoil of a grey-buff color. Clods friable. All passed through the coarse sieve except a little shot-iron ore and a small quartz pebble. Its siliceous residue passed through the fine sieve.

No. 2771—VIRGIN SOIL of *Red Oak Barrens, 4 miles east of Woodville.* Sample taken to the depth of 8 inches. Growth: red oaks, 10 to 15 feet high. Collected by R. H. Loughridge. Dried soil of a grey-brown color. Clods friable. All passed

*Of 64 meshes to the centimeter square.

†Of 1600 meshes to the centimeter square.

through the coarse sieve. The fine sieve separated a small quantity of fine hyaline quartz sand from its siliceous residue.

No. 2772—SUBSOIL of the next preceding. Taken from 8 to 12 inches deep. Collected by R. H. Loughridge.

Dried subsoil of a brownish-buff color. Lighter colored than the preceding. Clods friable. The coarse sieve removed from it 3.6 per cent. of shot-iron ore. All its siliceous residue passed through the fine sieve except a few small grains of quartz sand.

No. 2773—VIRGIN SOIL of Post Oak Flatwoods, 1 mile west of Paducah, on Hinkleville road. Taken 10 inches deep. Growth: chiefly post oak, a little red oak and hickory. Collected by R. H. Loughridge.

No. 2774—SUBSOIL of the next preceding. Sample taken from 10 to 14 inches deep. Collected by R. H. Loughridge.

Dried subsoil, yellowish-grey. Clods quite friable. The coarse sieve removed from it 3.1 per cent. of shot-iron ore. Its siliceous residue all passed through the fine sieve except a small quantity of fine white sand.

No. 2775—VIRGIN SOIL. Fine silty ash-colored soil of the Post Oak Flatwoods, near the county line, north of Woodville. Sample taken to the depth of 8 inches. Growth: post and red oaks. Collected by R. H. Loughridge.

Dried soil of a light grey or ashy color. Clods friable. All passed through the coarse sieve except 7.1 per cent. of shot-iron ore. Its siliceous residue all passed through the fine sieve.

No. 2776—SUBSOIL of the next preceding. Taken 6 to 12 inches below the surface. Collected by R. H. Loughridge.

Dried subsoil, very light grey. Its small clods are somewhat firm. The coarse sieve separated from it 5.4 per cent. of shot-iron ore. Its siliceous residue all passed through the fine sieve except a few grains of fine sand.

COMPOSITION OF THESE MCCRACKEN COUNTY SOILS.

(Calculated Dried at 212° F.)

Number in Report.	2767	2768	2769	2770	2771	2772	2773	2774	2775	2776
Organic and volatile matter	4.385	3.781	3.549	2.365	3.863	2.335	2.807	2.309	2.083	1.637
Alumina and manganese oxide	7.307	6.578	3.160	3.339	4.089	4.941	5.336	4.982	2.818	3.295
Iron peroxide	3.094	3.416	1.681	1.880	2.763	2.883	3.086	3.441	1.533	1.950
Lime carbonate . . . . .	.215	.164	.197	.121	.134	.097	.127	.171	.161	
Magnesia . . . . .	.046	.047	.327	.289	.220	.290	.394	.327	.161	.235
Phosphoric acid (P_2O_5) . . . . .	.110	.085	.096	.078	.121	.095	.095	.079	.062	.030
Potash extracted by acids . . . . .	.271	.227	.329	.282	.190	.216	.167	.302	.179	.125
Soda extracted by acids . . . . .	.119	.082	.583	not est.	.302	.168	.087	not est.	.145	not est.
Water expelled at 400° F. . . . .	.909	.488	.547	.379	.662	.885	.946	.761	.538	.463
Sand and insoluble silicates	83.233	84.790	90.050	91.147	88.033	88.309	87.213	87.476	92.726	92.642
Totals	99.689	99.608	100.519	99.880	100.377	100.219	100.258	99.774	100.416	100.538
Hygroscopic moisture	2.750	2.825	1.265	1.100	1.655	1.500	1.500	1.700	0.875	1.050
Potash in siliceous residue	1.215	1.343	1.621	1.467	1.513	1.252	1.428	1.435	1.446	1.566
Soda in siliceous residue . . . . .	.480	.500	1.050	.753	.518	.167	.704	.718	1.062	1.219
Character of the soil	Virgin.	Subsoil.								

No. 2767 contains an average proportion of organic and volatile matters, as well as good percentages of the other essential elements, with the one exception of magnesia. This is not likely, however, to prevent it from being a quite fertile soil, if the physical conditions, drainage, etc., are favorable. All the others, except No. 2771, contain less than a good average of phosphoric acid. Nos. 2775 and 2776 are especially deficient in this essential ingredient. Phosphatic fertilizers would be beneficial to all these, and especially to the latter mentioned soils. Lime is generally present in good average proportions, except in subsoils Nos. 2772 and 2774, and potash is in ample proportions in all. These soils are all composed of very finely divided materials, none of them containing any gravel or coarse sand. They ought all to be productive, with good management and economy of manures, if well drained, and the other physical conditions are favorable.

McCRACKEN COUNTY CLAYS.

No. 2777—CLAY. *Mr. Jones', 3 miles south of Paducah.*
Collected by R. H. Loughridge.

Dried clay of a light grey color. Fused with difficulty before the blow-pipe. Calcined white.

No. 2778—CLAY on *John Mitchell's place, 3 miles east of Lovelaceville.* Collected by R. H. Loughridge.

Dried clay of a light brownish-grey color. Fused grey before the blow pipe.

No. 2779—GYPSEOUS CLAY from *Mr. W. J. Hough's place, 4 miles west of Paducah.* Collected by R. H. Loughridge.

Dried clay, nearly white, with ferruginous stains in spots. Contains a very small proportion of sand. Fuses slightly before the blow-pipe. Calcines white.

No. 2780—BLUE MICACEOUS CLAY. *Tertiary; on Armstrong's place, 7 miles east of Paducah.* Collected by R. H. Loughridge.

Dried clay of a grey color. Contains minute specks of mica. Before the blow-pipe it fuses grey.

No. 2781—BLUE MICACEOUS CLAY, charged with blue particles of Vivianite. (See No. 2762 for a similar clay in Marshall county.) Collected by R. H. Loughridge.

Darker colored than the preceding; 56.60 per cent. of brownish sand, containing small mica scales, was washed out of it. The blue specks gave a marked reaction of phosphoric acid. Before the blow-pipe this clay fused grey.

COMPOSITION OF THESE McCACKEN COUNTY CLAYS.

(Air Dried.)

Number in Report.	2777	2778	2779	2780	2781
Silica	59.500	66.320	67.580	69.220	73.192
Alumina	24.960	22.930	20.040	17.540	16.540
Iron peroxide . . . . .	.720	1.190	.540	1.440	1.840
Lime . . . . .	.325	.437	1.743	.437	.369
Magnesia	396	209	.158	.858	.461
Potash	1.934	1.107	1.340	2.452	1.969
Soda . . . . .	.286	.470	.075	.472	.541
Water, etc.	11.879	7.337	8.524	7.581	5.088
Totals	100.000	100.000	100.000	100.000	100.000
Sand }	not est.	not est.	small proportion.	50.580	56.600

Nos. 2777 and 2779 are good plastic clays, suitable for the manufacture of white or whitish pottery ware. They are also quite refractory. Nos. 2778 and 2780, containing more iron peroxide, are rather less refractory, and calcine somewhat colored.

The large proportions of fine sand in Nos. 2780 and 2781 somewhat diminishes their plasticity, and their considerable percentages of iron peroxide and potash renders them fusible at a high temperature. Possibly very fine sand exists in some of the others, not easily removed by washing.

The Vivianite in No. 2781 is in too small quantity to make it available for phosphatic manure. No. 2778 contains some of its lime in the form of sulphate, but not in large proportion.

OLDHAM COUNTY.

No. 2782—MINERAL WATER from *Anita Springs*, residence of Dr. G. T. Berry, 1 mile from *Lagrange*. Flows from the cavernous layer of the *Clinton Group* of the *Upper Silurian*. Collected by W. M. Linney, September, 1885.

The water is transparent, colorless and inodorous. On evaporation it left 0.274 of a gramme of saline matters to the litre (about 1,000 grammes) of the water. These consist mainly of carbonates of lime and magnesia, sulphates of potash and soda, chloride of magnesium and silica. It is a pure weak saline water.

PERRY COUNTY COALS.

No. 2783—COAL. *Sixty-one inches*. *John Fields'*. Sampled by John T. Profitt from the lower 36 inches. Collected by G. M. Hodge.

A weathered sample of splint coal. Some fibrous coal between the thin laminæ, but no appearance of pyrites. Some ferruginous incrustation.

No. 2784—CANNEL COAL. *Ten inches* (in the same bed 24 inches of bituminous coal), 1 mile below *Rush Branch*, *Middle Fork Kentucky river*. Collected by G. M. Hodge.

A somewhat weathered sample. Ferruginous incrustation on some of the surfaces.

No. 2785—COAL. *Forty-four inches*. *William Boling's, Rush Branch of Middle Fork of Kentucky river*. Sample of the upper 20 inches. Collected by G. M. Hodge.

A pure-looking coal. No apparent pyrites. Some little fibrous coal.

No. 2786—COAL. Sample of the lower 20 inches of the same bed as the above. Resembles that coal, but is somewhat brighter.

No. 2787—COAL. *Fifty-six inches*. *Abner Campbell's. Fish Trap Branch of North Fork of Kentucky river*. Collected by G. M. Hodge.

Some portions dull, like cannel coal; others bright. Some fibrous coal between the laminæ, but no apparent pyrites.

No. 2788—COAL. *Forty-five inches*. *Thomas J. Johnson's, Ebersole Branch of Middle Fork of Kentucky river*. Collected by G. M. Hodge.

Apparently a splint coal, somewhat weathered. Some fibrous coal between the laminæ, but no apparent pyrites.

No. 2789—COAL. *Fifty two inches*. *John Spencer's, Grape-vine creek*. Sample of the lower 48 inches. Collected by G. M. Hodge.

Generally dull black. Fibrous coal and some little granular pyrites between the laminæ. Some portions bright pitch-black.

No. 2790—COAL. *Forty-eight inches*, mouth of *Guy's creek*, *Middle Fork of Kentucky river*. Sample of the upper 32 inches. Collected by G. M. Hodge.

Generally dull black splint coal. Some fine fibrous pyrites and fibrous coal. Portions shining pitch black.

No. 2791—COAL. *Forty inches*. *John Spencer, Grape-vine creek*. Collected by G. M. Hodge.

A somewhat weathered sample of splint coal.

No. 2792—COAL. *Thirty-nine inches*. *Joseph Campbell's, Mouth of Rock Lick Branch of North Fork of Kentucky river*. Collected by G. M. Hodge.

A weathered sample of splint coal.

No. 2793—COAL. *Thirty-nine inches*. *Alexander Combs', North Fork of Kentucky river*, 5 miles below *Hazard*. Collected by G. M. Hodge.

Apparently good splint or semi-bituminous coal. No apparent pyrites.

No. 2794—COAL. *Forty-five inches*. *Samuel Whittaker's, Willard creek*. Collected by G. M. Hodge.

Portions of the sample dull splint coal. Some fibrous coal between the laminæ, but no apparent pyrites. Some pieces bright pitch-black.

No. 2795—COAL. *Thirty-six inches*. *Peter Gross', Mine near the mouth of Squabble creek, Middle Fork of Kentucky river*. Collected by G. M. Hodge.

Generally pitch-black coal, breaking irregularly with irregular shining surfaces. A few pieces dull and laminated. No pyrites apparent, and but very little fibrous coal.

(Air Dried.)

Number in Report.	2783	2784	2785	2786	2787	2788	2789	2790	2791	2792	2793	2794	2795
Specific gravity	1.333	not est.	1.279	1.300	1.359	1.334	—	1.366	1.366	not est.	1.290	1.390	1.259
Hygroscopic moisture	3.50	0.80	1.20	5.26	3.30	4.36	3.40	6.48	2.80	1.76	3.96	1.96	—
Volatile combustible matters	35.30	44.80	39.60	30.34	34.90	30.34	31.60	36.04	29.60	36.04	32.84	37.10	61.00
Coke	61.20	54.40	59.20	62.90	64.40	65.30	65.60	67.60	63.20	62.20	63.20	62.20	—
Total	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
Total volatile matters	38.80	45.60	40.80	37.10	35.60	38.20	34.70	34.40	36.80	32.40	37.80	36.80	100.00
Fixed carbon in the coke	53.14	57.60	52.70	55.30	52.20	52.20	54.90	55.30	47.80	58.50	56.20	52.80	39.00
Ash	8.06	16.80	6.50	7.60	9.20	10.40	10.30	15.40	9.10	6.00	10.40	3.10	57.90
Total	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
Percentage of sulphur	1.035	0.970	1.327	0.654	0.763	0.475	0.450	0.557	0.491	0.505	0.557	0.722	0.749
Character of the coke	dense	pulverulent	spongy.	light	dense	friable.	very light	friable.	light	spongy.	light	light	—
Color of the ash	lt. brownish grey	lt. brownish grey	light lilac grey	nearly white	lt. purp'h grey	lt. purp'h grey	grey	grey	grey	grey	grey	grey	—

CHEMICAL REPORT.

CHEMICAL REPORT.

Of these Perry county coals only one, No. 2784, is a cannel coal, characterized in its composition by its larger percentage of volatile combustible matters than in the other samples, which are mostly splint or semi-bituminous coals. This cannel coal gives also a larger proportion of ash than the other coals, viz: 16.8 per cent.; yet the sum of its combustible materials is 82.4 per cent. The purest of all these samples is No. 2795, which gives only 3.1 per cent. of ash, and its total combustible matters amount to 95.0 per cent. As can be seen, several of these coals contain more than a good percentage of ash, which, however, will not prevent them from being valuable for all ordinary purposes, although not so available for making good coke as others which contain less earthy material. The sulphur percentage in these coals is generally moderate.

PULASKI COUNTY COALS.

No. 2796—COAL. *Barren Fork. The run of the mine. Sample of the coal taken for coking two years ago.* By R. C. B. Thruston.

No. 2797—COAL of the *Barren Fork Coal and Mining Company. Nut coal. Average sample of the coal taken for coking two years ago.* By R. C. B. Thruston.

COMPOSITION OF THESE PULASKI COUNTY COALS.

(Air Dried.)

Number in Report.	2796	2797
Hygroscopic moisture	2.32	2.12
Volatile combustible matters	32.48	31.56
Coke	65.20	66.32
Totals	100.00	100.00
Total volatile matters	34.80	33.68
Fixed carbon in the coke	59.10	59.02
Ash	6.10	7.30
Totals	100.00	100.00
Percentage of sulphur	1.077	1.879
Character of the coke	spongy.	spongy.
Color of the ash	light grey.	yellowish-grey.

Pretty good coals, containing 91.58 and 90.58 per cent. of total combustible matters severally. The ash and sulphur percentages are somewhat above a very good average for coking purposes.

WARREN COUNTY.

No. 2798—MARL from near the bottom of the Saint Louis limestone beds, near Bowling Green, about 100 feet above Barren river. Sample from the top, middle and bottom of a 4 foot bed. Average sample. Collected by M. H. Crump, Civil Engineer, April 30, 1885.

Of a light grey color, portions with ferruginous stains. Plastic with water. Powder of a light-buff color. Calcines nearly white, with a light reddish tint.

COMPOSITION.—(Air Dried.)

Silica	28.780
Alumina	11.631
Iron peroxide	2.960
Lime carbonate	43.760
Magnesia carbonate	6.320
Phosphoric acid ($P_2 O_5$) . . . . .	.249
Potash	2.124
Soda	not est.
Moisture and loss	4.176
	100.000

This marl would be beneficial as a top-dressing to light sandy soil which is deficient in lime. It could also be, no doubt, converted into water cement of the character of Portland cement, by proper admixture with more lime and calcination.

This marl may be said to contain a little more than 43 per cent. of clay (exclusive of moisture), and nearly 44 per cent. of carbonate of lime. Good artificial Portland cement is said to be made, in England, etc., from a mixture of 21 to 23 per cent. of clay, and 79 to 77 per cent. of chalk (which is nearly pure carbonate of lime). Ground limestone could be used, and the best proportions found by actual experiment.

No. 2798a—MINERAL WATER, from a bored well 502 feet deep; beginning about the middle of the St. Louis lime-

stone. Bored by Captain Smallhouse. Sample sent by M. A. Crump, Civil Engineer, Bowling Green.

The water, contained in a stoneware jug, was turbid with a yellowish material. Smelt strongly of hydrogen sulphide and petroleum; a little of the latter substance floating on it.

Qualitatively examined, it was found to contain chlorides, sulphates and sulphides of magnesium, calcium, sodium, &c. Its total solid saline matters is 5.09 per cent., most of which is sodium chloride—common salt. A pretty strong saline sulphur water.

WHITLEY COUNTY COALS.

No. 2799—COAL. Possum Branch of Wolf creek. Collected by A. R. Crandall. Three feet of coal, under a sandstone ledge; on farm of Joseph Cox.

A bright, pure-looking coal, showing very little fibrous coal, and no apparent pyrites.

No. 2800—COAL. Forks of Jellico creek. Jellico Creek Salt Works, at R. P. Crickmore's. Upper 38 inches of the main coal. Sample collected by A. R. Crandall.

A bright, pure-looking sample; fracture generally shining and somewhat irregular. Some few thin scales of bright pyrites, but very little fibrous coal apparent. Contains a few pieces of lamellar structure and dull appearance.

No. 2801—COAL. Right Fork of Bennett's creek. Coal 48 inches thick. Sample from the whole thickness, without parting.

A block coal or splint. Mostly bright, pure-looking coal, of irregular, shining fracture. A small portion more dull, and lamellar in structure. No pyrites or fibrous coal apparent.

No. 2802—COAL. Right Fork of Patterson creek. Pleasant Palley's coal. Fifty-two inches thick. Sample from the whole bed. Collected by A. R. Crandall.

A pure-looking coal, breaking generally with irregular fracture and shining surfaces; some pieces showing "bird's-eye" fracture with satiny lustre. A small portion lamellated. Hardly any fibrous coal and no pyrites apparent.

No. 2803—COAL. *Briar creek. W. Jones' coal, 28 inches thick. Sample from the whole face of the bed.* Collected by A. R. Crandall.

Apparently a pure splint or block coal. No pyrites, and but little fibrous coal apparent.

No. 2804—COAL. *Briar creek. Henry Green's coal, 3 feet thick. Sample from the whole thickness, from 20 feet in the entry.* Collected by A. R. Crandall.

A pure-looking, pitch-black coal, breaking generally with shining, irregular surfaces. But little fibrous coal and no pyrites apparent.

No. 2805—COAL. *Briar creek. Richardson's coal, 36 inches thick without parting. Average sample from the whole face.* Collected by A. R. Crandall.

Quite a pure-looking coal, of the character of the next preceding.

No. 2806—COAL. *Head of Little Patterson creek. M. A. Jones' coal. Average thickness, 3 feet without parting.* Collected by A. R. Crandall.

Quite a pure-looking, pitch-black coal, breaking with irregular shining surfaces. Portions lamellated with some fibrous coal, but no apparent pyrites.

No. 2807—COAL. *Tackett's creek. Main coal. Terrel Siler's. Two miles from the mouth, and half a mile above Mr. Siler's house. Bed 41 inches thick, with a half-inch parting 16 inches from the bottom.* Sample collected by A. R. Crandall.

Resembles the preceding.

No. 2808—COAL. *Mahan Station. Average sample of the upper 23 inches. (A parting of 5 inches.)* Sample collected by A. R. Crandall.

Coal resembles the preceding.

COMPOSITION OF THE TEN PRECEDING WHITLEY COUNTY COALS.

(Air Dried)

Number in the Report.	2799	2800	2801	2802	2803	2804	2805	2806	2807	2808
Specific gravity	1.293	1.285	1.282	1.279	1.271	1.281	1.414	1.262	1.277	1.321
Hygroscopic moisture	1.84	2.00	2.40	2.14	1.90	1.90	1.94	2.14	2.40	2.20
Volatile combustible matter	33.84	31.30	35.80	39.76	36.10	37.40	38.92	36.06	36.60	33.10
Coke	64.32	66.70	61.80	58.10	62.00	60.70	59.14	61.80	61.00	64.70
Totals	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
Total volatile matters	35.68	33.30	38.20	41.90	38.00	39.30	40.86	38.20	39.00	35.30
Fixed carbon in the coke	59.96	62.94	58.96	55.06	59.50	58.60	56.84	59.20	57.70	56.80
Ash	4.36	3.76	2.84	3.04	2.50	2.10	2.30	2.60	3.30	7.90
Totals	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
Percentage of sulphur	2.180	0.901	0.556	0.892	0.997	0.928	0.764	0.755	0.708	4.234
Character of the coke										
Color of the ash										

Most of these are remarkably pure coals, their ash percentages extending from 2.10 per cent. in No. 2804 up to 7.90 in No. 2808. This latter is exceptional, not only in its much greater ash proportion, but in the extraordinary amount of sulphur it contains, viz: 4.234 per cent. This must have been present in the sample as very fine granular iron pyrites, as was rendered probable by the large amount of iron contained in its ash. Its total combustible matters, including the sulphur, is 89.9 per cent.

No. 2804 contains 96 per cent. of combustible matters, with its 2.1 per cent of ash.

The ash proportions vary, in the other samples, from 3.76 down to 2.30 per cent. These are all, except No. 2808, remarkably good, pure coals, and no doubt would make very good coke. As several of them are somewhat soft coals, approaching so called bituminous coals, their coke may be light and spongy unless made under pressure.

WHITLEY COUNTY COALS—Continued.

No. 2809—COAL. *Mahan's coal. Mahan's Station; eighteen inches below the parting. Average sample.* Collected by A. R. Crandall.

Resembles the next preceding.

No. 2810—COAL. *W. M. Mahan's coal. Mahan's Station. Eighteen inches of the bottom; 13 inches of the top, with a 5-inch parting. Average sample of the whole bed.* Collected by A. R. Crandall.

A pure-looking, pitch-black coal; breaking with shining irregular surfaces. Very little fibrous coal, and no pyrites apparent.

No. 2811—COAL. *Caddell's. Wolf creek. Bed 37 inches thick, with a slight parting. Sample from near the outcrop.* Collected by A. R. Crandall.

A somewhat weathered sample of what appears to be a good coal.

No. 2812—COAL. *Thomas' cannel coal. Head of Left Fork of Wolf creek. Splint coal, with some cannel at the bot-*

tom. Twenty-six inches near the outcrop. Sample collected by A. R. Crandall.

A much weathered sample.

No. 2813—COAL. *Lower 26 inches of the R. P. Crickmore coal. (Upper part previously sampled.)* Collected by A. R. Crandall.

A bright, pure-looking, pitch-black coal; breaking generally with irregular shining surfaces. Very little fibrous coal, and no pyrites apparent.

No. 2814—COAL. *B. P. Shelby's. Upper 22 inches.* Collected by A. R. Crandall.

A pure-looking sample of what seems to be a splint coal. But little fibrous coal, and no pyrites apparent.

No. 2815—COAL. *Wagner Siler's. On Mud Creek. Forty inches thick, without parting. Average sample from the whole face of the bed.* Collected by A. R. Crandall.

A pure-looking coal; generally breaking with irregular shining surfaces. Some portions lamellated, with some little fibrous coal, but no apparent pyrites between.

No. 2816—COAL. *J. S. Berry's. Jellico seam. Sample from coal collected two years ago for coking.* By R. C. B. Thruston.

CHEMICAL REPORT.

Number in Report.	2809	2810	2811	2812	2813	2814	2815	2816
Specific gravity	1.271	1.311	1.359	1.387	1.263	1.341	1.293	n. e.
Hygroscopic moisture	2.20	1.80	1.50	7.26	1.70	2.24	2.58	2.00
Volatile combustible matters	84.86	36.70	40.56	33.84	37.40	35.66	33.12	34.82
Coke	62.94	61.50	57.94	58.90	60.90	62.10	64.30	63.18
Totals	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
Total volatile matters	37.06	38.50	42.06	41.10	39.10	37.90	35.70	36.82
Fixed carbon	58.14	58.50	51.24	53.20	59.36	58.76	62.70	60.48
Ash	4.80	3.00	6.70	5.70	1.54	3.34	1.60	2.70
Totals	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
Percentage of sulphur	1.340	1.093	2.768	0.640	1.721	1.060	0.670	0.629
Character of the coke	spongy, light purplish grey.		dense spongy pulverulent, dark grevish grey purple.		spongy, light purplish grey.		light spongy, light brown, salmon color.	
Color of the ash. {	brownish grey.		grey brown.		light brown.		brown grey.	

CHEMICAL REPORT.

These are good, and some of them very good coals. The highest ash percentage—in No. 2811—is 6.70. This approaches cannel coal in composition, and contains 91.80 per cent. of combustible matters, including 2.768 per cent. of sulphur, a large proportion of the latter.

The lowest ash proportions in these coals is in Nos. 2813 and 2815, being only 1.54 and 1.60 per cent. severally.

No. 2813 contains 96.76 per cent. of combustible matters, including 1.721 per cent. of sulphur.

No. 2815 contains 95.82 per cent. of combustible matters, including 0.670 per cent. of sulphur.

No. 2816 contains 95.30 per cent. of combustible matters, including 0.629 per cent. of sulphur.

No. 2810 contains 95.20 per cent. of combustible matters, including 1.093 per cent. of sulphur.

No. 2814 contains 94.42 per cent. of combustible matters, including 1.060 per cent. of sulphur.

No. 2809 contains 93.00 per cent. of combustible matters, including 1.340 per cent. of sulphur.

All of these six coals could no doubt be made available in the manufacture of coke. Those would, of course, be preferred which contained the least sulphur and ash. An example of the coke made from one of these (No. 2816) is given below.

No. 2817—COKE. (No. 14.) *Of J. S. Berry's coal. Jellico series. Five miles north of Williamsburg, Whitley county.*

Seventy-two hours' coke. Made at Quinnimont, West Virginia, March 20th-23d. R. C. B. Thruston.

COMPOSITION.—(Air Dried).

Moisture, etc., expelled at red heat	1.50
Fixed carbon	93.30
Light brownish-grey ash	5.20
	100.00
Percentage of sulphur	0.382

Comparing its sulphur percentage with that of the coal from which it was made, it will be seen that a large propor-

tion of it was removed in the process of coking. This, no doubt, is the case with most coals; the quantity removed varying according to the condition or form of combination of the sulphur in the coal.

APPENDIX.

For comparison with Kentucky cokes and coking coals, a number of samples of both, of West Virginia, were collected by Mr. Thruston, the results of the analyses of which are given in the following pages:

WEST VIRGINIA COALS.

No. 2818—COAL. (Sample 11.) *Three miles above the mouth of Preacher creek, or Callahan creek, of Rolling Fork of Powell's river, Wise county. Sample of the 27-inch cannel coal of the bed.* Collected by R. C. B. Thruston.
A dull-looking cannel coal.

No. 2819—COAL. *Quinnimont Mines, Fayette county. Thickness of bed where sampled, 34 inches.* Collected by R. C. B. Thruston.

A bright, pure-looking coal. Fracture irregular, with shining surfaces. No pyrites or fibrous coal apparent.

No. 2820—COAL. *Fire creek, Fayette county.* Collected by R. C. B. Thruston.

No. 2821—COAL. *Stone Cliff, Fayette county. Upper seam, above the conglomerate; bed 4 feet 3 inches to 5 feet.* Sample from the 4 feet 3 inches. Collected by R. C. B. Thruston.

A pure-looking, pitch black coal. Somewhat laminated. Fracture generally irregular, with shining surfaces.

No. 2822—COAL. *Stone Cliff, Fayette county. Quinnimont seam. Coal 44 to 52 inches; no parting.* Sample from where it measures 46 inches. Collected by R. C. B. Thruston.

No. 2823—COAL. *Sewell, Fayette county. On top of the conglomerate. From 34 to 42 inches thick.* Collected by R. C. B. Thurston.

A pure-looking, soft coal. Irregular fracture, with shining surfaces. Fibrous coal, but no pyrites apparent.

No. 2824—COAL. *Hawksnest, Fayette county, West Virginia. Sample exclusive of parting.* Collected by R. C. B. Thruston.

A pure-looking, pitch-black coal. Fracture irregularly cuboidal, with shining surfaces. Some little fibrous coal apparent.

Number in Report.	2818	2819	2820	2821	2822	2823	2824
Hygroscopic moisture	0.86	0.40	0.60	0.90	0.80	1.06	
Volatile combustible matters	38.54	18.00	20.80	19.10	22.14	32.34	
Coke	60.60	81.60	78.60	80.00	77.06	66.60	
Totals	100.00	100.00	100.00	100.00	100.00	100.00	100.00
Total volatile matters	39.40	18.40	21.40	20.00	22.94	33.40	
Fixed carbon	47.84	79.00	75.34	73.60	74.46	62.00	
Ash	12.76	2.60	3.26	6.40	2.60	4.60	
Totals	100.00	100.00	100.00	100.00	100.00	100.00	100.00
Percentage of sulphur	0.711	0.491	0.418	0.491	0.848	0.464	0.629
Character of the coke	dense friable.		light spongy.	light spongy.	much inflated.	spongy.	
Color of the ash	{ chocolate brown.		light brownish grey.	light buff-grey.	light brownish-grey.	light buff-grey.	

CHEMICAL REPORT.

CHEMICAL REPORT.

With the exception of No. 2818, which is a cannel coal, and No. 2824, these West Virginia coals are quite remarkable because of their small proportions of volatile combustible matters, and generally small ash, as well as the very light or inflated cokes they leave when heated under the atmospheric pressure only. They also present the singular fact that their cokes are of very difficult incineration.

WEST VIRGINIA COKES.

No. 2825—COKE. *Forty-eight hours. Made at Quinnimont, of Quinnimont coal.* March 22d-24th, 1886. R. C. B. Thruston.

No. 2826—COKE. *Of Hawksnest coal, Fayette county. Made in Solendorf Coppé oven, at Quinnimont.* Collected by R. C. B. Thruston.

No. 2827—COKE. *Forty-eight hours. Of Fire creek coal, Fayette county. Made at Quinnimont.* March 26th, 1886. Collected by R. C. B. Thruston.

No. 2828—COKE. *Forty-eight hours. Of Stone Cliff coal, Fayette county. Made at Quinnimont.* Collected by R. C. B. Thruston.

No. 2829—COKE. *Forty-eight hours. Of Stone Cliff coal, Fayette county. Made at Quinnimont.* March 16th, 1886. Collected by R. C. B. Thruston.

No. 2830—COKE. *Seventy-two hours. Of Stone Cliff coal, Fayette county. Made at Quinnimont.* Collected by R. C. B. Thruston.

No. 2831—COKE. *Forty-eight hours. Of Sewell coal. Made at Quinnimont.* Collected by R. C. B. Thruston.

No. 2832—COKE. *Seventy-two hours. Made of Sewell coal, at Quinnimont.* Collected by R. C. B. Thruston.

CHEMICAL REPORT.

Number in Report.	2825	2826	2827	2828	2829	2830	2831	2832
Moisture expelled at red heat .	2.20	0.40	1.70	0.86	0.36	1.60	0.50	1.60
Fixed carbon	92.00	90.50	92.90	96.40	89.80	92.90	91.80	91.80
Ash	5.80	9.10	5.40	6.40	3.24	8.60	6.60	6.60
Totals	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
Percentage of sulphur	0.491	0.711	0.401	0.437	0.519	0.821	0.560	0.478
Color of the ash {	brownish-grey.	light grey-brown.	brownish-grey.	light buff-grey.	light reddish brown.	light brownish-grey.	light brownish-grey.	light brown-grey.

CHEMICAL REPORT.

These are, generally, quite good cokes, No. 2830 being the only one which presents ash and sulphur a little above good average proportions.

The variation in the proportions of moisture is no doubt accidental. The purest of them all is No. 2829, containing 96.40 per cent. of fixed carbon, and only 3.24 per cent. of ash, with 0.519 of sulphur.

BELL COUNTY.

COALS.

No. 2833—COAL. (Sample 1.) *On John R. Slusher's land, Left Fork of Straight creek, Bell county.* Collected by R. C. B. Thruston, June 2d, 1886.

A weathered sample, incrusted in part with ferruginous material. Sample from the upper two seams, 6 and 31 inches in thickness, severally, separated by 1 inch of shale. Another seam of 5 inches of coal, separated from these two beds by 5 inches of shale, was not sampled.

COMPOSITION.—(Air Dried.)

	Per cent.	Per cent.	
Hygroscopic moisture	1.40	Total volatile matters	38.50
Volatile combustible matters	37.10	Fixed carbon in the coke	56.30
Dense spongy coke	61.50	Brown ash	5.20
	100.00		
Percentage of sulphur	1.151		100.00

A good semi-bituminous coal, containing rather more volatile combustible matters than the very best coking coal.

No. 2834—COAL. (Sample 2.) *James Green's, on the divide between Browney's and Hansee's creeks, Bell county.* Collected by R. C. B. Thruston, July 13th, 1886.

A pure-looking, pitch-black coal, generally of cuboidal structure; breaking with irregular, shining surfaces. Some portions somewhat lamellated, and of somewhat dull fracture. Very little fibrous coal, and no pyrites apparent.

This sample is of the upper seam of 38 inches, separated, in this bed, by a 20-feet space, from the lower two seams of coal.

No. 2835—COAL. (Sample 12.) *From James Green's lower bank. Sample from the 26 inch seam of coal lying 20 feet below the coal from which sample 2 (No. 2834) was taken, and separated from coal of sample 13 (No. 2836) by a 2-inch parting of shale.* Sample collected by R. C. B. Thruston, September 24th, 1886.

A pure-looking, pitch-black, hard coal, resembling the brighter, harder portions of the next preceding sample.

No. 2836—COAL. (Sample 13.) *From James Green's bank. Sample from the 21-inch seam lying under coal of sample 12 (No. 2835), and separated from that by a 2-inch layer of shale.* Collected by R. C. B. Thruston, September 24th, 1886.

A bright, pitch-black, firm coal; structure cuboidal; breaking with irregular, shining surfaces. No fibrous coal or pyrites apparent.

COMPOSITION OF THESE COALS OF JAMES GREEN'S BANK.

(Air Dried.)

Number in Report.	2834	2835	2836
Hygroscopic moisture	0.60	1.20	1.00
Volatile combustible matters	35.00	32.20	35.40
Coke	64.40	66.60	63.60
Totals	100.00	100.00	100.00
Total volatile matters	35.60	33.40	36.40
Fixed carbon in the coke	61.90	61.60	61.70
Ash	2.50	5.00	1.90
Totals	100.00	100.00	100.00
Percentage of sulphur	1.068	0.574	0.629
Character of the coke	very dense. light grey-brown.	inflated. brownish-grey.	inflated. light salmon- colored.
Color of the ash	{		

These are remarkably good, pure coals, containing very small amounts of ash material, and small proportions of sulphur, more especially the latter two described. They could no doubt be used for the manufacture of coke, although they contain rather more volatile combustible matters than the most profitable coking coals.

No. 2837—COAL. (Sample 3a.) *Fifteen miles above Pineville, on Muddy Branch of Clear creek, Bell county. Sample of the upper 34 inches of the bed.* Collected by R. C. B. Thruston, July 15th, 1886.

A somewhat weathered sample of splint, or semi-cannel coal.

No. 2838—COAL *from lower part, 43 inches in thickness, of the same bed as the next preceding.* Collected by R. C. B. Thruston, July 15th, 1886.

A much soiled and weathered sample of cannel coal.

COMPOSITION OF THESE TWO COALS.—(Air Dried.)

Number in Report.	2837	2838
Hygrometric moisture	1.70	1.00
Volatile combustible matters	32.60	51.60
Coke	65.70	47.40
Totals	100.00	100.00
Total volatile matters	34.30	52.60
Fixed carbon in the coke	62.30	40.40
Ash	3.40	7.00
Totals	100.00	100.00
Percentage of sulphur	0.684	0.739
Character of the coke	spongy. light grey- brown.	dense. brown.
Color of the ash	{	

These are both very good coals of their kind, and no doubt, when mined deeper in the bed, would leave less ash than these weathered samples. The cannel coal is very rich in volatile combustible matters. The upper layer would no doubt furnish good coke.

No. 2839—COAL. (Sample 4.) *On James Bussell's land, on Cannon creek, Bell county.* Collected by R. C. B. Thruston, July 20th, 1886. Two seams of coal, 25 and 23 inches thick severally, separated by 17 inches of shale, lie under a shale roof, on a clay floor.

A weathered and soiled sample.

COMPOSITION.—(Air Dried.)

Hygroscopic moisture	0.80	Total volatile matters	34.76
Volatile combustible matters	33.90		33.20
Light spongy coke	65.30	Carbon in the coke	59.90
		Grey-brown ash	5.40
100.00			100.00
Percentage of sulphur	1.508		

This is a very good splint or semi-cannel coal, verging toward bituminous coal, containing quite a moderate proportion of ash material, and but little more than the average percentage of sulphur.

No. 2840—COAL. (Sample 9.) *Feelan Risner's, on Browney's creek, Bell county.* Sample collected by R. C. B. Thruston, September 22d, 1886.

A weathered sample.

No. 2841—COAL. (Sample 10.) *From the same bed as the next preceding sample, there being only a 1-inch parting of shale between them.*

COMPOSITION OF THESE TWO SAMPLES.—(Air Dried.)

Number in Report.	2840	2841
Hygroscopic moisture	5.40	1.60
Volatile combustible matters	30.00	47.40
Coke	64.60	51.00
Totals	100.00	100.00
Total volatile matters	35.40	49.00
Fixed carbon in the coke	60.50	47.70
Ash	4.10	3.30
Totals	100.00	100.00
Percentage of sulphur	0.436	0.574
Character of the coke	{ pulveru- lent. d'k salmon colored.	{ pulveru- lent. dark brown.
Color of the ash		

Both these samples had been somewhat altered by long weathering, the effects of which would be the reduction of the

volatile combustible matters and sulphur, with probably an increase of the ash percentage. The removal of the volatile ingredients caused the production of a pulverulent coke. Deeper in the bed, where the coal has not been altered by long weathering, the coke of No. 2840 would no doubt be spongy coherent. No. 2841 has yet the large percentage of volatile combustible matters which characterizes the cannel coals.

No. 2842—COAL. (Sample 5.) *Head of Middle Fork of Williams' Branch of Yellow creek, Bell county.* Collected by R. C. B. Thruston, July 24th, 1886.

This sample is from four several seams, which are, respectively, beginning at the top, 17, 12, 11, and 25 inches thick, divided by shale partings, which are, severally, 7, 2, and 2 inches thick. Another bed of coal, not included in the sample, lies beneath, under a thicker shale parting.

This mixed sample was generally pitch-black coal, of cuboidal structure, breaking with shining, irregular surfaces, containing very little coal of lamellar structure, very little fibrous coal, and no apparent pyrites.

COMPOSITION—(Air Dried.)

	Per cent.	Per cent.	
Hygroscopic moisture	1.60	Total volatile matters	34.80
Volatile combustible matters	33.20	Carbon in the coke	60.60
Light spongy coke	65.20	Light grey-brown ash	4.60
	100.00		100.00
Percentage of sulphur	0.876		

This sample has the composition of a good coking coal.

No. 2843—COAL. (Sample 6.) *Land of J. M. Robbins, on Crane creek of Yellow creek, Bell county.* Sample by R. C. B. Thruston, from the upper 36-inch seam of the bed, September 21st, 1886.

A pure-looking, pitch-black coal; structure mostly cuboidal. Fracture irregular, with shining surfaces. Very little fibrous coal, and no pyrites apparent.

No. 2844—COAL. (Sample 7.) *From the lower 23-inch seam*

of the same bed as the next preceding sample, separated from that by a 3-inch shale parting.

A pure-looking, pitch-black coal; breaking with irregular, shining surfaces. Very little fibrous coal, and no pyrites apparent.

COMPOSITION OF THESE COALS.—(Air Dried.)

Number in Report.	2843	2844
Hygroscopic moisture	1.40	1.20
Volatile combustible matters	32.30	34.90
Coke	66.30	63.90
Totals	100.00	100.00
Total volatile matters	33.70	36.10
Fixed carbon in the coke	63.50	62.10
Ash	2.80	1.80
Totals	100.00	100.00
Percentage of sulphur	0.670	0.529
Character of the coke	dense.	spongy.
Color of the ash	lt. brown-grey.	salmon-colored.

Both these coals are remarkably pure and good, containing only very small proportions of ash material and sulphur. They would doubtless produce very good coke.

No. 2845—COAL. (Sample 8.) *From John M. Marricle's bank, on Cubbog Branch of Browney's creek, Bell county.* Collected by R. C. B. Thruston, September 22d, 1886. Coal, 39 inches: the upper 3 inches of bone coal; lowest 12 inches, soft coal; gas coal, 24 inches, between.

A pretty pure-looking sample, mainly of splint or semi-cannel coal. Portions breaking irregularly, with shining surfaces. But little fibrous coal or pyrites apparent.

No. 2846—COAL. (Sample 11.) *On Richard Risner's land, on Hansee's creek, Bell county.* Collected by R. C. B. Thruston, September 24th, 1886. Sample from the two layers, severally 16 and 53 inches thick, separated by a 1-inch shale parting, the roof being the soil.

A much weathered sample.

No. 2847—COAL. (Sample 14.) *On Andrew Marricle's land, on Cubbog creek, Bell county.* Collected by R. C. B. Thruston, October 6th, 1886. Sample from the two layers, severally 21 and 25 inches thick, separated by a 1-inch parting, with shale roof and clay floor.

A weathered sample.

No. 2848—COAL. (Sample 15.) *On Stone Coal Branch of Browney's creek.* Sample from the upper four layers, severally of 23, 14, 2½, and 20 inches thickness, separated by thin shale partings; shale roof and clay floor. Another 3-inch coal and a 5-inch shale parting lie below these above the floor.

A weathered sample.

No. 2849—COAL. (Sample 16.) *Near the head of Browney's creek, Bell county.* Forty-four inches, including half an inch of shale 8 inches from the top. Collected by R. C. B. Thruston, October 11th, 1886.

A firm, pure-looking, pitch-black coal. Structure generally cuboidal. Fracture with irregular, shining surfaces. Little or no fibrous coal, and no pyrites apparent.

COMPOSITION OF THESE FIVE BELL COUNTY COALS.—(Air Dried.)

Number in Report.	2845	2846	2847	2848	2849
Hygroscopic moisture	0.80	2.20	4.10	2.60	1.40
Volatile combustible mat'rs.	35.30	32.60	29.90	33.20	34.60
Coke	63.90	65.20	66.00	64.20	64.00
Totals	100.00	100.00	100.00	100.00	100.00
Total volatile matters	36.10	34.80	34.00	35.80	36.00
Fixed carbon in the coke	60.20	61.80	61.80	59.60	61.80
Ash	3.70	3.40	4.20	4.60	2.20
Totals	100.00	100.00	100.00	100.00	100.00
Per cent. of sulphur	0.425	0.601	0.739	0.931	0.821
Character of the coke	spongy.	pulverulent.	dense friable.	dense spongy.	dense spongy.
Color of the ash	light grey-brown.	salmon-colored.	d'k salmon-colored.	light brown.	d'k salmon colored.

These are all very good coals. The samples, Nos. 2846, 2847, and 2848, show one of the effects of weathering in their large proportions of moisture. They all would give very good coke, their ash percentage being all below a good average, No. 2849 giving an exceptionally low ash.

BELL COUNTY COALS.—(Continued.)

No. 2850—COAL. *On Four-mile creek of Cumberland river, Bell county. Geological position: Lower Sandy Branch seam. Bed 37 inches thick.* Average sample collected by R. C. Ballard Thruston, July 1st, 1887.

A very pure-looking, semi-cannel coal. No pyrites apparent in the sample. Breaking in laminæ, generally with shining, irregular surfaces. Very little fibrous coal apparent.

No. 2851—COAL. (Sample 2.) *One and a half miles up Four-mile creek of Cumberland river, Bell county. Geological position: 100 feet above Sand Branch coal.* Collected July 1st, 1887, by R. C. B. Thruston.

Apparently a weathered sample of splint coal. This bed has four seams of coal, 4 to 28 inches thick severally; separated by three shale partings, which are severally from 4 to 17 inches thick.

No. 2852—COAL. (Sample 3.) *Four-mile creek of Cumberland river. Geological position: upper Sandy Branch seam.* Collected by R. C. B. Thruston, July 1st, 1887.

A weathered sample of apparently splint coal.

No. 2853—COAL. (Sample 4.) *Four-mile creek of Cumberland river.* Collected by R. C. B. Thruston, July 1st, 1887. The bed, 745 feet above drainage, has two seams of coal, severally 17 and 21 inches thick, separated by a 1-inch shale parting.

Apparently a weathered sample of what seems to be a splint or semi-cannel coal.

No. 2854—COAL. (Sample 9.) *On Shade Branch of Bennett's Fork of Yellow creek, Bell county. Geological position:*

Hignite seam, 775 feet above drainage. Collected by R. C. B. Thruston, July 15th, 1887.

Coal generally breaking irregularly, with irregular, shining surfaces. Some portions imperfectly laminated. No pyrites apparent, and but very little fibrous coal.

No. 2855—COAL. (Sample 18.) *Head of Steward's Branch, one and a half miles from Pineville, Bell county. Geological position: top of lower coal measures.* Collected by R. C. B. Thruston, November 16th, 1887.

The bed contains four seams of coal, severally from 3 to 20½ inches thick, separated by two half-inch shale partings. This sample is from the upper two seams. The uppermost seam is so badly weathered as to resemble earth rather than coal.

No. 2856—COAL. (Sample 19.) *Head of Steward's Branch, one and a half miles from Pineville, Bell county. Geological position: top of lower coal measures. Sample from the 10½ and 3-inch seams. Same bed as preceding sample.* Collected by R. C. B. Thruston, November 16th, 1887.

COMPOSITION OF THESE BELL COUNTY COALS.

(Air Dried.)

Number in Report.	2850	2851	2852	2853	2854	2855	2856
Hygroscopic moisture	2.00	4.40	4.60	7.60	1.44	6.70	0.30
Volatile combustible matters	34.60	29.50	28.80	28.94	32.56	30.10	29.76
Coke	63.40	66.10	66.60	63.46	66.00	63.20	69.94
Totals	100.00	100.00	100.00	100.00	100.00	100.00	100.00
Total volatile matters	36.60	33.90	33.40	36.54	34.00	36.80	30.06
Fixed carbon in coke	60.40	60.50	63.60	55.26	53.34	49.80	55.74
Ash	3.00	5.60	3.00	8.20	12.66	13.40	14.20
Totals	100.00	100.00	100.00	100.00	100.00	100.00	100.00
Percentage of sulphur	0.507	0.978	0.506	0.603	1.454	1.125	2.965
Character of the coke	dense.	very dense.	pulverulent.	dense spongy.	pulverulent.	dense.	light purplish-grey.
Color of the ash	light brown.	brown-grey.	light brown.	light brown.	brownish-grey.	brownish-grey.	light purplish-grey.

CHEMICAL REPORT.

CHEMICAL REPORT.

The so-called cannel coal, No. 2854, owes its dense structure to the large proportion of earthy matters which it contains, giving it a composition approximating that of bituminous shale. Nos. 2855 and 2856 also contain large proportions of ash material, and all three of these coals have quite large proportions of sulphur, more especially No. 2856.

The four other coals, viz: those from Four-mile creek, are remarkably pure, good coals, with ash percentages, severally, of from 3 to 8.20 per cent., and sulphur from 0.506 to 0.978 per cent. These four coals would probably yield good coke, notwithstanding samples Nos. 2852 and 2853 gave a pulverulent coke in our analysis; this fact being very probably owing to the weathered condition of the samples taken. The unweathered coal, from the interior of the bed, would very likely give a good, firm coke.

No. 2857—COAL. *Three-quarters of a mile above the mouth of Kit Island Branch of Straight creek, six miles from Pineville. Bed 3 feet 9 inches thick. Geological position: Sandy Branch coal. Collected by R. C. B. Thruston, March 13th, 1888.*

A jet-black, pure-looking coal, breaking generally irregularly, with irregular, shining surfaces. No pyrites, and but little fibrous coal apparent.

COMPOSITION.—Air Dried.

	Per cent.	Per cent.
Hygroscopic moisture	1.40	36.74
Volatile combustible matters	35.34	60.26
Much inflated coke	63.26	3.00
	100.00	100.00
Percentage of sulphur	1.222	

A remarkably good semi-cannel coal.

No. 2857a—LIMONITE IRON ORE. (Sample No. 17.) *On the north face of Pine Mountain, three and a half miles east of Pineville, Bell county. Oriskany ore. Shows about 6 to 8 inches. Collected by R. C. B. Thruston, November 15th, 1887.*

A dark-brown, irregularly cellular ore, mixed with some lighter brown ochreous ore.

COMPOSITION.—Air Dried.

Iron peroxide	60.517 = 42.362 iron.
Alumina	5.723
Lime and magnesia carbonates	traces.
Phosphoric acid . . . . .	.259
Siliceous residue	23.940
Water and loss	9.561
	100.000

CLINTON COUNTY.

SOILS.

No. 2858—VIRGIN SOIL. *Hill-side limestone soil. Long's Vineyard, Cartwright's Post-office, Clinton county. Sample taken to the depth of 10 inches. Forest growth: walnut, white oak, sugar-tree, and poplar. On St. Louis carboniferous limestone formation.* Collected by R. H. Loughridge.

Soil friable, of a light, dirty, brownish-grey color. All passed through the coarse sieve,* except about 12.5 per cent. of small, irregular fragments of ferruginous sandstone or concretions. Its siliceous residue from digestion in acids all passed through the fine sieve,† except a very small proportion of fine white sand.

No. 2859—VIRGIN SUBSOIL. *Hill-side limestone subsoil. Long's Orchard, Cartwright Post-office, Clinton county. Sample taken at the depth between 10 and 13 inches.* Collected by R. H. Loughridge.

Slightly lighter-colored than the above surface soil; in pretty firm clods. All passed through the coarse sieve, except about 4 per cent. of irregular, small fragments of ferruginous sandstone or concretions. Its siliceous residue left only a small quantity of fine white sand on the fine sieve.

No. 2860—SOIL. *Mountain sandy soil. Sewell's Mountain,*

* The coarse sieve has about 64 meshes to the centimeter square.

† The fine sieve has about 1600 meshes to the centimeter square.

of Poplar Mountain range, near Cartwright's Post-office, Clinton county. Forest growth: chestnut, chestnut oak, black gum; some red and white oaks. Sample taken to the depth of 10 inches. Collected by R. H. Loughridge. Geological position: on lower coal measures.

Soil of a light buff-grey color; some friable clods. All passed through the coarse sieve, except one or two small fragments of ferruginous sandstone or concretions. Its siliceous residue all passed through the fine sieve, except about 8.3 per cent. of fine white sand.

No. 2861—VIRGIN SOIL, *from one mile west of Cartwright's Post-office. Taken to the depth of 12 inches. Forest growth: chestnut and red oak. Said to be the poorest soil in Clinton county, excepting that of Poplar Mountain summit.* Collected by R. H. Loughridge.

Soil of a light, dirty, buff-grey color; contains some friable clods. All passed through the coarse sieve, except about 4 per cent. of small fragments of ferruginous sandstone or concretions. Its siliceous residue left about 4.5 per cent. of fine white sand on the fine sieve.

No. 2862—RED UNDER-CLAY, *of the chestnut soil, from one mile west of Cartwright's Post-office, Clinton county. Sample taken from 18 to 24 inches below the surface.* Collected by R. H. Loughridge.

Subsoil of a dull, orange-red color, in friable clods. When powdered, it is of a handsome orange tint. The coarse sieve removed from it about 8.9 per cent. of irregular small fragments of ferruginous sandstone. Its siliceous residue all passed through the fine sieve, except about 2.5 per cent. of fine white sand.

COMPOSITION OF THESE CLINTON COUNTY SOILS.

(Calculated Dried at 212° F.)

Numbers in Report.	2858	2859	2860	2861	2862
Organic and volatile mat'rs	3.511	2.998	2.985	2.618	5.483
Alumina	6.757	6.215	4.243	4.361	7.335
Iron and manganese ox'es					13.188
Lime carbonate	.405	.305	.151	.051	trace.
Magnesia	.073	.055	.145	.109	.240
Phosphoric acid (P ₂ O ₅)	.146	.065	.097	.064	.267
Potash extracted by acids	.340	.537	.351	.247	.231
Soda extracted by acids	.518	.247	.317	.256	.077
Water expelled at 400° F.	.846	.860	.514	.453	1.285
Sand and insoluble silicates.	87.366	88.706	90.784	91.928	71.047
Totals	99.962	99.988	99.587	100.087	99.153
Moisture expelled at 212° F.					
Potash in siliceous residue	1.368	1.625	0.705	0.700	2.625
Soda in siliceous residue	.394	.497	.417	.422	.171
not est.	.214	not est.	not est.	not est.	not est.
Fine white sand	small.	small.	8.300	4.532	2.567
Gravel and rock fragments.	12.500	4.269	2.361	4.030	9.940
Character of the soil	virgin.	v. subsoil.	sandy.	virgin.	under-clay.

With the exception of Nos. 2858 and 2862, phosphoric acid is deficient in these soils, more especially in Nos. 2859 and 2861. Carbonate of lime is quite deficient in Nos. 2861 and 2862. Organic and volatile matters are very small in proportion in all, especially in Nos. 2859, 2860, and 2861, and are only in small proportions in Nos. 2858 and 2862. In the latter soil, very probably, combined water of the iron oxide, driven off at red heat, increases the small sum. Alumina and iron oxide are in very large proportions in 2862, more especially the iron oxide, which gives to the soil its orange-red color. In 2860 and 2861 these ingredients are quite deficient. Potash was found in larger proportions in all than their general character and large proportions of sand and insoluble silicates seemed to warrant. These insoluble materials, it is seen, are quite large in all but No. 2862, more especially in Nos. 2860 and 2861. Such sandy soils can only be made permanently productive by a judicious use of appropriate fertilizers.

HARLAN COUNTY.

COALS.

No. 2863—COAL. *Head of Luna's creek, about 1400 feet above the river at Big Stone Gap, Harlan county. Upper part of the bed 59 inches thick; lower part 15 inches; separated by a 1½-inch parting.* Collected by A. R. Crandall, June 25th, 1887.

A pure-looking, pitch-black coal; generally irregularly laminated, with some little fibrous coal between the laminae. Portions breaking irregularly, with shining, irregular surfaces. No pyrites apparent in the sample.

No. 2864—CANNEL COAL. (Sample 6.) *Eight miles from Mount Pleasant, at the head of Catteran's creek of Martin's Fork, Harlan county.* Collected by R. C. B. Thruston, July, 1887. Sample from a 22-inch seam, in bed containing three seams, two of stone-coal, severally 18 and 6 inches thick, separated by a 2 inch shale parting; 120 feet above drainage.

A dull, grey-black cannel coal; irregularly laminated. No fibrous coal or pyrites apparent in sample.

No. 2865—COAL. (Sample No. 7.) *At head of Catteran's creek of Martin's Fork, 155 feet above drainage; eight miles above Mount Pleasant, Harlan county.* Collected by R. C. B. Thruston, July, 1887.

A bright, pitch-black coal; fracture irregularly cuboidal and irregular, with shining surfaces. No pyrites or fibrous coal apparent.

No. 2866—COAL. (Sample No. 8.) *On John Bell Branch, head of Catteran's creek of Martin's Fork, nine miles from Mount Pleasant, Harlan county; 365 feet above drainage.* Collected by R. C. B. Thruston, July, 1887, from two lower seams in a bed containing five several seams of coal, separated by shale partings.

Apparently a splint coal, somewhat weathered. Some little granular pyrites apparent in the sample.

No. 2867—COAL. (Sample 11.) *From near the head of Catteran's creek of Martin's Fork of Cumberland river, Harlan*

county. Collected by R. C. B. Thruston, August 2d, 1887. Sample from three upper seams of a bed containing several seams, some of which are separated by shale partings. A very badly weathered sample.

No. 2868—COAL. (Cannel?) (Sample 12.) *From the lower two seams of the same coal bed from which the next preceding sample was taken. Seams severally 12 and 16 inches thick, separated by a 9-inch shale parting.* Collected by R. C. B. Thruston, August 8th, 1887.

Resembles a cannel coal.

No. 2869—COAL. (Sample 13.) *On Trace Branch of Clover creek of Cumberland river, Harlan county.* Collected by R. C. B. Thruston, September 2d, 1887.

Sample mostly in a much crumbled condition.

No. 2870—COAL. (Sample 14.) *On Slick Rock Branch of Clover Fork of Cumberland river.* Collected by R. C. B. Thruston, September 3d, 1887. Sample from the three lower seams of a bed containing four or five seams, separated by thin shale partings.

Sample much crumbled and somewhat weathered.

No. 2871—COAL. (Sample 21.) *From near the mouth of Terry's Branch of Wallen's creek, Harlan county. Geological position: near the base of the lower coal measures.* Collected by R. C. B. Thruston, November 17th, 1887. Received at laboratory January 26th, 1888.

A pure-looking, jet-black coal, breaking generally irregularly, with irregular, shining surfaces. No pyrites or fibrous coal apparent in the sample. Sample taken from the lowest seam, 23 inches thick, from a bed containing three different seams of coal.

No. 2872—COAL. (Cannel?) (Sample 20.) *From two upper seams of the same coal bed as the next preceding. Seams severally 8 and 13 inches thick.*

A dull-black coal, breaking imperfectly in laminæ. Fracture sometimes very flat conchoidal. No pyrites or fibrous coal apparent in the sample.

COMPOSITION OF THESE HARLAN COUNTY COALS.

(Air Dried.)

Number in Report.	2863	2864	2865	2866	2867	2868	2869	2870	2871	2872	
Hygroscopic moisture	3.00	1.66	1.86	1.74	2.50	0.80	1.40	3.60	0.90	0.90	
Volatile combustible matters	31.40	42.80	30.74	33.32	31.90	37.30	32.00	29.40	34.30	30.10	
Coke	65.60	55.54	67.40	64.94	65.60	61.90	66.60	67.00	64.80	69.00	
Totals	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	
Total volatile matters	34.40	44.46	32.60	35.06	34.40	38.10	33.40	33.00	35.20	31.00	
Carbon in the coke	56.30	55.44	65.00	59.24	61.80	54.90	62.30	57.00	62.50	42.40	
Ash	9.30	20.10	2.40	5.70	3.80	7.00	4.30	10.00	2.30	26.60	
Totals	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	
Percentage of sulphur	0.604	0.549	0.493	1.034	0.438	1.925	0.712	0.622	0.577	1.084	
Character of the coke	{ dense.			{ spongy.			{ dense.			dense, inflated.	
Color of the ash	{ lt. grey-brown.			{ light brown.			{ spongy, light brown.			light grey-brown.	
	{ lt. buff-grey.			{ lt. grey-brown.			{ lt. grey-brown.			lt. grey-brown.	

The cannel coals. Nos. 2864 and 2872, are diminished in value by their 20.10 and 26.60 percentages of ash; otherwise they may be usefully employed as fuel. No. 2868 resembles a cannel coal, but gave only 37.30 per cent. of volatile combustible matters, and left a dense coke. Its ash is only 7.00 per cent., which is small for cannel coals, but its sulphur is nearly 2 per cent.

Nos. 2865, 2867, 2869, 2866, and 2871 are very good coals, their ash percentages being severally only 2.40, 3.80, 4.30, 5.70, and 2.30.

The ash percentages of Nos. 2863, 2864, 2870, and 2872, are much larger, being severally 9.30, 20.10, 10.00, and 26.60 per cent.

The weathered samples of coals always show to a disadvantage in their analyses, owing to loss of their volatile combustible matters and the admixture of earthy materials.

HARLAN COUNTY COALS.—(Continued.)

No. 2873—COAL. (Sample 17.) *Head of Puckett's creek, Harlan county. Sample from two upper seams, 41 and 5 inches severally, separated by a 2-inch shale parting; in a bed which contains nine seams of coal, separated by partings of shale, varying from half an inch to 18 inches in thickness.* Collected by R. C. B. Thruston, October, 1886. (This coal is 80 feet above coal sample 18, near the top of the 10 feet 10 inch bed.)

Apparently a good splint coal, showing but little fibrous coal, and no apparent pyrites.

No. 2874—COAL. (Sample 18.) *Head of Puckett's creek, Harlan county. Sample 80 feet below sample 17. Coal 44 inches thick. Clay beneath.* Collected by R. C. B. Thruston, October 12th, 1886.

Mostly splint coal, with some softer coal of irregular fracture. No apparent pyrites, and but little fibrous coal.

No. 2875—COAL. (Sample 19.) *Near head of Puckett's creek, Harlan county. Coal 54 inches thick; 665 feet*

below that of sample 18. Collected by R. C. B. Thruston, October 12th, 1886.

A pure-looking coal; mostly splint, with some softer coal of irregular fracture, with shining surfaces.

COMPOSITION OF THESE PUCKETT CREEK COALS.—(Air Dried.

Number in Report.	2873	2874	2875
Hygroscopic moisture	4.00	2.40	1.80
Volatile combustible matters	31.00	34.20	34.20
Coke	65.00	63.40	64.00
Totals	100.00	100.00	100.00
Total volatile matters	35.00	36.60	36.00
Fixed carbon in the coke	56.00	60.60	60.10
Ash	9.00	2.80	3.90
Totals	100.00	100.00	100.00
Percentage of sulphur	1.027	0.684	0.917
Character of the coke	friable.	dense spongy.	dense spongy.
Color of the ash	grey-brown.	grey-brown.	brownish-grey.

The coals Nos. 2874 and 2875, very much alike in composition, are remarkably good splint or semi-cannel coals, which would produce coke of the best quality. No. 2873 contains more ash material than these, but its large proportion of moisture indicates that the sample was from the weathered outcrop of the bed, and it is probable that the coal deeper in the bank, where it has not undergone partial decomposition under the atmospheric agencies, will be found to be much more pure.

No. 2876—COAL. (Sample 20.) *Land of James Howard, on Martin's Fork of Cumberland river, at base of the Cumberland mountains, Harlan county. Sixty-eight inches of solid coal.* Sample collected by R. C. B. Thruston, October 14th, 1886.

A somewhat weathered sample of splint coal.

No. 2877—COAL. (Sample 21.) *James Howard's, on Black mountain, Martin's Fork, Harlan county; 250 feet above*

drainage. Sample collected by R. C. B. Thruston, October 14th, 1886.

A pretty pure-looking sample of splint coal. Some portions of irregular fracture, with shining surfaces. Very little fibrous coal, and no pyrites apparent.

No. 2878—COAL. (Sample 22.) *On Broad Branch of Martin's Fork, Harlan county. Coal 43 inches thick.* Sample collected by R. C. B. Thruston, October 14th, 1886.

A pure-looking, pitch-black coal, breaking readily with irregular shining surfaces. No fibrous coal or pyrites apparent.

No. 2879—COAL. (Sample 25.) *On Crumbie's Branch of Martin's Fork of Cumberland river, Harlan county.* Sample collected by R. C. B. Thruston, October 16th, 1886. Two seams of coal, 36 and 5 inches thick severally, separated by an 11-inch slate parting.

A pure-looking, firm, pitch-black splint or semi-cannel coal. But little fibrous coal, and no pyrites apparent.

COMPOSITION OF THESE MARTIN'S FORK COALS.—(Air Dried.)

Number in Report.	2876	2877	2878	2879
Hygroscopic moisture	2 00	1.10	1.20	1.20
Volatile combustible matters	33.40	32.90	33.00	35.10
Coke	64.60	66.00	65.80	63.70
Totals	100.00	100.00	100.00	100.00
Total volatile matters	35.40	34.00	34.20	36.30
Fixed carbon in the coke	61.60	63.40	61.80	57.10
Ash	3.00	2.60	4.00	6.60
Totals	100.00	100.00	100.00	100.00
Percentage of sulphur	0.643	0.519	0.628	1.906
Character of the coke	very dense. light salmon-colored.	very dense. dark salmon-colored.	dense spongy grey-brown.	dense. grey-purple.
Color of the ash	{			

Nos. 2876, 2877, and 2878 are remarkably good coals, and could be profitably used in the manufacture of the best quality of coke. No. 2879 contains rather more ash and sulphur, and less fixed carbon, yet is also a very good coal of the semi-cannel variety.

HARLAN COUNTY COALS.—(Continued.)

No. 2880—COAL. (Sample 23.) *On land of G. W. Smith, on Crank's creek, Harlan county. Coal 43 inches thick, with sandstone roof, and floor of clay 2 inches thick, resting on sandstone.* Collected by R. C. B. Thruston, October 15th, 1886.

A somewhat weathered sample.

No. 2881—COAL. (Sample 24.) *On Crank's creek, Harlan county. Forty two inches of solid coal, 400 feet above that of sample 23.* Collected by R. C. B. Thruston, October 15th, 1886.

A bright, pitch-black coal, breaking generally with irregular shining surfaces. But little fibrous coal, and no pyrites apparent.

COMPOSITION OF THESE CRANK'S CREEK COALS.—(Air Dried.)

Number in Report.	2880	2881
Hygroscopic moisture	3.20	2.80
Volatile combustible matters	33.60	32.00
Coke	63.20	65.20
Totals	100.00	100.00
Total volatile matters	36.80	34.80
Fixed carbon in the coke	56.80	62.80
Ash	6.40	2.40
Totals	100.00	100.00
Percentage of sulphur	1.782	0.354
Character of the coke	very dense. light	dense. light
Color of the ash	brown.	brown.

No. 2881 is a remarkably good, pure coal, which would yield very good coke. No. 2880, a weathered sample, probably does not fairly represent the character of the unweathered coal deeper in the bed; yet it is better than the general average of coals in quality, leaving only 6.40 per cent. of ash. Its considerable proportion of sulphur might be objectionable when it is applied to some purposes.

HARLAN COUNTY COALS.—(Continued.)

No. 2882—COAL. (Sample A.) *Head of Luna's creek of Poor Fork of Cumberland river, Harlan county. Geological position: upper coal measures. Total thickness of seam, 6 feet 6 inches, but only 5 feet sampled. Collected by R. C. B. Thruston, December 12th, 1887.*

Sample somewhat weathered, and partly in a powdered condition. Some portions dull-black.

No. 2883—COAL. (Sample B.) *Head of Camp Fork of Luna's creek, Harlan county. Upper coal measures. Collected by R. C. B. Thruston, December 13th, 1887.*

Sample somewhat weathered; partly pulverized.

No. 2884—COAL. (Sample C.) *Head of Rockhouse Branch of Luna's creek, Harlan county. Upper coal measures. Collected by R. C. B. Thruston, December 18th, 1887.*

A pure-looking coal, generally. Some portions imperfectly laminated, with some little granular pyrites and fibrous coal apparent; other portions breaking irregularly, with shining, irregular surfaces.

No. 2885—COAL. (Sample D.) *Near the mouth of Luna's creek of Poor Fork of Cumberland river, Harlan county. Collected by R. C. B. Thruston, December 14th, 1887.*

A pure-looking coal, mostly imperfectly laminated. Some surfaces brilliant and irregular; others dull, showing a little fine granular pyrites.

No. 2886—COAL. (Sample E.) *Elkhorn bed, near the mouth of Luna's creek, Harlan county. Thirty feet above the last sample, and 270 feet above the bed of the creek. Collected by R. C. B. Thruston, December 14th, 1887.*

A pure-looking coal, breaking generally irregularly, with shining surfaces. Very little fibrous coal or pyrites apparent.

No. 2887—COAL. *Near the mouth of Luna's creek of Poor Fork of Cumberland river, Harlan county. Geological position: 25 feet above sample E. Bed 48 inches thick. Collected by R. C. B. Thruston, December 14th, 1887.*

A much weathered sample.

No. 2888—COAL. (Sample G.) *Cold Iron Branch of Poor Fork of Cumberland river, Harlan county. Lower coal measures. Bed 42½ inches. Collected by R. C. B. Thruston, December 18th, 1887.*

A good-looking coal. Mostly lamellar in structure. Portions breaking irregularly, with irregular, shining surfaces. Some little granular pyrites and fibrous coal apparent in the sample.

No. 2889—COAL. (Sample H.) *Cold Iron Branch of Poor Fork of Cumberland river, Harlan county. Elkhorn bed of lower coal measures, 25 feet above sample G. Bed 55½ inches thick. Collected by R. C. B. Thruston, December 15th, 1887.*

Generally a fine-looking coal. Breaking with irregular, shining surfaces. Some portions laminated, and more dull in appearance, with some little fine granular pyrites apparent.

No. 2890—COAL. *On Turkey-pen Branch, 15 miles, on Poor Fork, above Harlan Court-house, Harlan county. Lower coal measures. Collected by R. C. B. Thruston, December 22d, 1887.*

COMPOSITION OF THESE HARLAN COUNTY COALS.

(Air Dried.)

Number in the Report.	2882	2883	2884	2885	2886	2887	2888	2889	2890
Hygroscopic moisture	1.90	3.20	2.10	2.20	5.70	9.60	1.80	2.40	2.30
Volatile combustible matters	28.90	28.06	32.90	33.80	32.90	30.20	31.60	31.70	31.50
Coke	69.20	68.74	65.00	64.00	61.40	60.20	66.60	65.90	66.20
Totals	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
Total volatile matters	30.80	31.26	35.00	36.00	38.60	39.80	33.40	34.10	33.80
Carbon in the coke	61.10	60.44	56.60	61.00	58.80	50.12	63.70	61.60	61.60
Ash	8.10	8.30	8.40	3.00	2.60	10.08	3.40	2.20	4.60
Totals	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
Percentage of sulphur	0.486	0.541	0.774	0.552	0.425	0.560	1.181	0.312	0.560
Character of the coke	{ spongy dense frangible light brown. light grey-brown.	{ dense spongy very light brown. lt. brown grey.	{ dense spongy very light brown. lt. brown grey.	{ spongy light brown. lt. brown grey.	{ light brown. lt. brown grey.				

CHEMICAL REPORT.

CHEMICAL REPORT.

These are, generally, very good coking coals, yielding from 60.20 per cent. in No. 2887, up to 69.20 per cent. in No. 2882. Their proportions of ash range from 2.20 per cent. in No. 2889 up to 10.08 in No. 2887, and 8.10, 8.30, and 8.40, severally, in Nos. 2882, 2883, and 2884. But 2887 was a much weathered sample, and the other three had also been somewhat altered by exposure, and may not, therefore, fairly represent the character of the interior of the beds. The sulphur is quite small, except in Nos. 2888 and 2884.

No. 2891—IRON ORE. (*Limonite.*) From 27 miles above Harlan Court-house, on Poor Fork of Cumberland river, Harlan county. Position: near base of lower coal measures. Collected by R. C. B. Thruston, December 2d, 1887.

COMPOSITION.—(Air Dried.)

Iron peroxide	44.200	= 39.940 iron.
Alumina	9.080	
Lime carbonate	20.000	
Magnesia carbonate	4.238	
Phosphoric acid (P_2O_5)	2.726	= 1.173 phosphorus.
Sulphur	a trace.	
Silica	12.600	
Water and loss	7.156	
	100.000	

KNOX COUNTY.

No. 2892—COAL. Two and a half feet thick; on Golden Fork of Poplar creek, Knox county. Collected by A. R. Crandall.

COMPOSITION.—(Air Dried.)

	Per cent.	Per cent.	
Hygroscopic moisture	0.40	Total volatile matters	37.60
Volatile combustible matters	37.20	Fixed carbon in the coke	56.46
Light spongy coke	62.40	Light grey ash	5.94
	100.00		100.00
Percentage of sulphur	0.820		

A good, pure coal.

CHEMICAL REPORT.

LAUREL COUNTY.

No. 2893—COAL. *S. E. Owsley's, Laurel county.* Sample brought by A. R. Crandall, August, 1886.

COMPOSITION.—(Air Dried.)

	Per cent.	Per cent.
Hygroscopic moisture	3.40	
Volatile combustible matters . .	33.80	37.20
Dense spongy coke	62.80	58.80
	<hr/>	<hr/>
	100.00	100.00
Percentage of sulphur	0.930	
	<hr/>	<hr/>

A very good coal, which would doubtless make good coke.

No. 2894—COAL from near *Lily, Laurel county.* Bed 46 inches thick. Sample collected December 25th, 1887, by Dr. L. H. Blanton.

A bright, pure-looking coal, breaking generally irregularly, with irregular, shining surfaces. No pyrites or fibrous coal apparent in the sample.

COMPOSITION.—(Air Dried.)

	Per cent.	Per cent.
Hygroscopic moisture	2.70	
Volatile combustible matters . .	34.60	37.30
Spongy coke	62.70	59.70
	<hr/>	<hr/>
	100.00	100.00
Percentage of sulphur	1.923	
	<hr/>	<hr/>

A good semi-cannel coal, giving but a small proportion of ash. Its somewhat large proportion of sulphur might be a drawback in the use of its coke in the iron manufacture.

LIVINGSTON COUNTY.

No. 2895—HYDRAULIC LIMESTONE from *Smithland, Livingston county.* Sent from Frankfort for analysis, January 9th, 1888.

A compact, very dark-grey limestone.

CHEMICAL REPORT.

COMPOSITION.—(Air Dried.)

	Per cent.
Lime	46.788
Magnesia . . . . .	.782
Alumina and iron oxide	12.170 with a trace of phosphoric acid.
Potash . . . . .	.057
Soda . . . . .	.039
Silica	9.000 including 0.8 of soluble silica.
Carbonic acid and moisture	31.164
	<hr/>
	100.000

This has the composition of some hydraulic limestones; but it does not contain as much silica, alumina, and iron oxide as the harder-setting cements, and may not be as durable as these. It will require much care in its calcination, because when too much burnt it loses its property of hardening under water. In an experiment made by the writer, the powdered stone having been submitted to a red heat for two hours, then mixed with water to a paste, and, after standing for a quarter of an hour, put under water, hardened after a day or so; but another portion, which had been heated for a longer time, did not harden much under water in twenty-four hours.

MARION COUNTY.

MINERAL WATERS.

No. 2896—MINERAL WATER, from the well of *Mr. Charles H. Burns, in the town of Lebanon, Marion county.* The same water was struck about 45 feet from the base of the black slate, in the mud sandstone, just above the Hudson group; also, in the gas well now being bored near the Burns well. The water is in large quantity. In the gas well the water tastes strongly of sulphur.

Sample, collected by Mr. W. T. Knott, was sent in quart bottles, well corked and sealed. It had no smell of sulphur when received, June 19th, 1887.

No. 2897—WATER, from *Harrison's spring, about 2 miles east of Lebanon, Marion county;* in the ash-colored shales lying just above the black slate. Sample collected by W. T. Knott, June 17th, 1887.

No. 2898—WATER, from Johnston's well, about 2 miles east of Lebanon. This water comes from the black slate formation near its base. Sample sent by Mr. W. T. Knott, June 17th, 1887.

COMPOSITION OF THESE MARION COUNTY MINERAL WATERS.

(In 1000. parts of the waters.)

Numbers.	2896	2897	2898
Carbonic acid gas . . .	small quants.		
Hydrogen sulphide gas . . .	not est.	none.	small quantities; not estimated.
Lime carbonate . . .	0.107	0.650	small quantity; not estimated.
Magnesia carbonate . . .	.020	.170	small quantity; not estimated.
Iron carbonate . . .	.023		held in solution by the carbonic acid.
Sodium chloride . . .	12.767	.132	small quantity; not est.
Calcium chloride . . .	1.062		
Magnesium chloride . . .	.857		
Potassium chloride . . .	.201		
Calcium sulphate . . .	.109		small quantity; not est.
Magnesium sulphate . . .	.230	4.014	small quantity; not est.
Potassium sulphate . . .	.187		
Sodium sulphate . . .		1.658	
Sodium sulphide . . .			small quantity; not est.
Lithia and bromine . . .	traces.		
Organic matter . . .	trace.		
Silica . . .	.010	not est.	not estimated.
Total saline matters, in 1000. parts . . .	15.263	7.934	1.760

The water of No. 2896 is a good saline chalybeate, with but a small proportion of hydrogen sulphide; that of 2897, containing only about half as much total saline matters, has a larger proportion of magnesium sulphate (Epsom salt), and also of calcium and sodium sulphates. It (No. 2897) is a good weak saline water. No. 2898 is a very weak saline water, containing a little sodium sulphide and hydrogen sulphide, which may give it a weak sulphurous taste when fresh from the well.

MUHLENBERG COUNTY.

COKE.

No. 2899—COKE, made of coal from three-quarters of a mile northwest of Mud River Coal Mines, Mud River, Muhlen-

berg county, Kentucky. Land of William Willis, Jr. Bed 44 inches thick. Samples sent from Frankfort, October 8th, 1887.

There were two samples in the box, made from the upper and lower part of the bed, of pure-looking coke. Average portions of the two were mixed and analyzed.

COMPOSITION.—(Air Dried.)

Moisture and volatile matters expelled at red heat	0 20-
Carbon in the coke	90 20-
Purplish-grey ash	9.60
	100 00

Percentage of sulphur 1.26

A good average coke.

No. 2900—CANNEL COAL. On land of G. F. McNary, near the western border of Muhlenberg county. Bed 22 inches thick, overlying coal No. 11. Sample collected by Charles Eaves, Greenville, Muhlenberg county.

Coal generally dull black; imperfectly laminated. Some portions breaking with imperfect, broad conchoidal fracture. Some surfaces shining, and one part iridescent. No fibrous coal, and only a few bright scales of pyrites apparent.

COMPOSITION.—(Air Dried.)

	Per cent.	Per cent.
Hygroscopic moisture	2.66	
Volatile combustible matters	36.74	Total volatile matters 39.40
Spongy coke	60.60	Carbon in the coke 42.20
		Dark purplish-brown ash 18.40
	100.00	100 00

Percentage of sulphur 7.526

This coal contains too much sulphur and ash materials to be profitable in competition with better neighboring samples.

PIKE COUNTY.

IRON ORE.

No. 2901—LIMONITE IRON ORE. Collected by C. M. Parsons, Pike county, Kentucky. Sent from Frankfort January 3d, 1888.

A pretty dense ore, dark brown in the denser portions; brownish-yellow in the more friable parts.

COMPOSITION.—(Air Dried.)

	Per cent.
Iron peroxide	66.37 = 46.46 iron.
Alumina	12.27
Phosphoric acid (P_2O_5)	3.04 = 1.319 phosphorus.
Lime carbonate . . . . .	.20
Magnesia	a trace.
Siliceous residue	2.60
Sulphur	a trace.
Water and loss	15.52
	100.00

A rich iron ore, containing but little sulphur, and more than average phosphorus.

SIMPSON COUNTY.

No. 2902—SULPHUR WATER. *Sample sent by the Board of Council of the town of Franklin, for quantitative analysis. Sample in two half-gallon bottles; received June 16th, 1887. (Analysis paid for by the Board of Council.)*

COMPOSITION.—(In 1000. parts of the water.)

Carbonic acid gas		amount not estimated.
Hydrogen sulphide gas		
Calcium carbonate	0.1518	
Magnesium carbonate . . . . .	.0044	
Iron carbonate . . . . .	.0169	
Sodium chloride . . . . .	.1700	
*Sodium sulphide . . . . .	.0930	
Iron sulphide . . . . .	.0044	In the sediment in the bottles.
Potassium sulphate . . . . .	.0184	
Calcium sulphate . . . . .	.7410	
Magnesium sulphate	1.3050	
Silica . . . . .	.0078	
Boracic acid	a trace;	not estimated.
Organic matters	a trace;	not estimated.
Total saline matters in 1000 parts of the water	2.5127	

A good saline sulphur water, resembling Blue Lick water, but containing much less sodium chloride (common salt) than that. It also has much more magnesium sulphate (Epsom salt) than that celebrated mineral water, making it more aperient in its action.

* Probably more of this salt would be found in the water analyzed fresh from the well.

WHITLEY COUNTY.

COALS.

No. 2903—COAL. *Upper two feet of Bennett's coal. (Overlying 7 inches of fire-clay.) On Harp's creek, Whitley county. Sample collected by A. R. Crandall.*

No. 2904—COAL. *Lower 3 feet of Bennett's coal, &c. Collected by A. R. Crandall.*

COMPOSITION.—(Air Dried.)

	Number in Report.	2903	2904
Hygroscopic moisture		2.46	1.60
Volatile combustible matters		34.14	34.00
Coke		63.40	64.40
Totals	100.00	100.00	100.00
Total volatile matters		36.60	35.60
Fixed carbon in the coke		57.80	56.80
Ash		5.60	7.60
Totals	100.00	100.00	100.00
Percentage of sulphur		0.848	0.820
Character of the coke		spongy.	spongy.
Color of the ash		brownish-grey.	light grey.

They are both good coals, of the splint variety. The upper bed gives rather the purer sample.

WHITLEY COUNTY COALS.—(Continued.)

No. 2907—COAL, *from the Procter Company's coal mine, Indian creek, Whitley county. Entry No. 7, Room No. 12. Average sample from the whole face of the bed. Upper bench 21 inches thick; lower bench, 22 inches. Collected by A. R. Crandall, March 12th, 1888.*

A pure-looking, jet-black coal; breaking generally irregularly, with irregular, shining surfaces. Imperfectly laminated. Very little fibrous coal, and no pyrites apparent in the sample.

No. 2908—COAL, from same mine. Entry No. 5, Room No. 10. Average of the lower 22 inch seam. Collected by A. R. Crandall, same date as the above sample.
Resembles the preceding.

No. 2909—COAL, from same mine. Entry No. 5. Average sample of the upper bench. Collected as above stated.
Resembles the preceding samples.

COMPOSITION OF THESE COALS.—(Air Dried.)

Number in Report.	2907	2908	2909
Hygroscopic moisture	2.00	2.60	1.80
Volatile combustible matters	33.70	33.20	35.00
Coke	64.30	64.20	63.20
Totals	100.00	100.00	100.00
Total volatile matters	35.70	35.80	36.80
Fixed carbon in the coke	61.90	62.20	60.60
Ash	2.40	2.00	2.60
Totals	100.00	100.00	100.00
Percentage of sulphur	0.796	0.769	0.714
Character of the coke	light spongy. very light brownish-grey.	light spongy. light grey-brown.	light spongy. very light brownish-grey.
Color of the ash	{		

These are remarkably good semi-cannel coals, containing remarkably small proportions of ash, and not an inordinate percentage of sulphur. They would yield very good coke if proper means were used in the coking to prevent it from being too light and spongy.

TENNESSEE COALS.

No. 2905—COAL. (Sample 10.) Head of Little Coal Branch of Tackett's creek of Clear Fork of Cumberland river, Claiborne county, Tennessee. Collected by R. C. B. Thruston, July 15th, 1887. Geological position: Dean's coal. Sample from lower seam, 40 inches thick, of the bed, which contains three seams of coal.

A pure-looking coal, breaking generally with shining, irregular surfaces. Imperfectly laminated. No pyrites or fibrous coal apparent in the sample.

No. 2906—COAL. (Sample 11.) Mouth of Big Sugar Branch of Bennett's Fork of Yellow creek, Claiborne county, Tennessee. Sample from a 19-inch middle seam, in a bed containing two other seams of coal, 34 and 7 inches thick, severally. Collected by R. C. B. Thruston, July 15th, 1887.

COMPOSITION OF THESE TENNESSEE COALS.—(Air Dried.)

Number in Report.	2905	2906
Hygroscopic moisture	2.10	7.00
Volatile combustible matters	34.24	30.90
Coke	63.66	62.10
Totals	100.00	100.00
Total volatile matters	36.34	37.90
Fixed carbon in the coke	55.26	58.30
Ash	8.40	3.80
Totals	100.00	100.00
Percentage of sulphur	1.427	0.685
Character of the coke	{ dense.	pulveru- lent.
Color of the ash	{ light pur- plish-grey.	lt. brown- ish-grey.

No. 2906 appears to be a weathered sample.

CHEMICAL REPORT.

TABLE I.—COALS.—(Air Dried.)

Number	County.	Coke.	Ash.	Character of the coke.	Color of the Ash.	Specific gravity	Remarks.	
							Sulphur	Ash.
2578	Bell	0.86	41.54	57.66	50.66	7.00	5.978	Grey-brown
2579	Bell	1.00	34.92	64.10	55.70	8.40	5.978	Purplish-grey
2580	Bell	.88	37.72	61.40	38.66	57.40	4.00	Light grey-brown
2581	Bell	1.20	33.94	65.26	34.74	58.86	4.00	Light spongy
2582	Bell	1.20	37.90	60.99	39.10	57.78	3.12	Light spongy
2583	Bell	1.16	36.84	62.00	38.00	57.59	4.30	Light spongy
2584	Bell	1.40	38.65	60.00	40.00	57.30	4.00	Light spongy
2585	Bell	2.00	35.20	62.80	37.20	58.88	4.00	Light spongy
2586	Bell	1.50	36.00	65.66	34.40	60.00	5.66	Light spongy
2587	Bell	1.92	36.08	63.00	36.00	58.00	5.00	Light spongy
2588	Bell	2.20	33.94	63.86	36.14	62.06	1.80	Light spongy
2610	Breathitt	2.80	36.60	63.66	36.40	54.20	9.40	Light brownish-grey
2611	Breathitt	2.00	35.36	62.64	37.36	57.36	5.28	Brownish-grey
2612	Breathitt	7.40	30.20	62.40	37.66	52.04	1.019	White
2613	Breathitt	3.80	34.49	61.80	38.20	51.86	10.36	Very light salmon
2614	Breathitt	9.60	32.90	62.80	37.20	54.48	10.00	Pulverulent
2615	Breathitt	2.80	31.16	66.04	33.00	53.34	12.80	Light brownish-grey
2616	Breathitt	3.80	32.39	63.90	36.10	48.80	15.10	Light reddish
2617	Breathitt	8.0	41.70	53.20	53.90	52.00	2.10	Pulverulent
2618	Breathitt	1.20	53.80	45.00	55.00	39.40	5.54	Light pink
2619	Breathitt	1.00	41.10	57.90	42.10	57.00	11.20	Light brick-colored
2620	Clay	1.10	35.66	63.30	36.70	56.70	6.40	Light brownish-grey
2621	Clay	1.20	38.00	60.70	39.30	54.90	1.00	Light brownish-grey
2622	Clay	1.48	35.92	62.60	37.40	54.70	7.90	Light lilac-grey
2623	Clay	1.46	34.84	63.70	36.30	57.70	6.30	Light lilac-grey
2624	Clay	0.92	37.54	61.54	38.46	53.44	8.10	Nearly white
2625	Clay	1.42	32.38	62.80	32.80	52.00	32.00	Light brownish-grey
2626	Clay	2.30	29.40	67.80	32.20	51.00	1.080	Dark brown
2627	Clay	1.60	34.28	64.12	35.88	54.82	9.30	Light brown
2628	Clay	1.30	44.16	55.54	44.46	43.74	11.80	Dense
2629	Harlan	1.60	33.30	65.10	34.90	49.70	15.40	Dense
2630	Harlan	1.12	33.68	65.20	34.80	63.10	2.10	Spongy
2631	Harlan	1.34	34.40	61.08	35.00	53.48	3.00	Light brownish-grey
2632	Harlan	1.60	35.00	63.40	36.60	52.52	6.00	Light purplish-grey
2633	Harlan	1.60	35.20	66.40	33.60	57.20	9.20	Reddish-brown
2634	Harlan	2.30	33.30	64.40	35.60	57.20	7.20	Lilac-grey
2635	Harlan	2.50	34.30	63.20	36.80	58.70	4.50	Brownish
2636	Harlan	1.00	29.50	69.50	30.50	51.00	34.60	Pulverulent

Number	County.	Coke.	Ash.	Character of the coke.	Color of the Ash.	Specific gravity	Remarks.	
							Sulphur	Ash.
2675	Harlan	4.62	32.98	62.40	37.60	58.39	4.10	Pulverulent
2676	Harlan	6.08	32.72	61.20	38.80	58.20	3.00	Light brown
2677	Harlan	1.90	36.00	62.10	37.90	56.10	3.00	Spongy
2678	Harlan	2.02	34.94	63.60	36.40	52.70	12.30	Light salmon
2679	Harlan	1.76	34.04	60.70	36.50	54.84	3.10	Very light grey
2680	Harlan	1.60	37.70	60.70	37.80	52.90	29.60	Light spongy
2681	Harlan	1.04	21.88	77.00	22.92	52.00	47.48	Light spongy
2682	Harlan	1.50	35.30	63.20	36.80	60.24	2.96	Pulverulent
2683	Harlan	1.52	33.00	65.00	34.50	51.96	1.04	Dense
2684	Harlan	1.84	31.12	67.04	32.98	52.28	4.76	Spongy
2685	Harlan	1.58	34.20	61.60	34.40	53.20	3.40	Light buff
2686	Harlan	6.18	34.24	59.58	40.42	52.88	7.86	Pulverulent
2687	Harlan	2.20	33.52	64.28	33.80	55.72	8.56	Light buff
2688	Harlan	1.80	35.00	63.20	36.80	57.30	5.99	Dense
2689	Harlan	1.80	32.20	64.60	35.40	50.20	9.40	Spongy
2690	Harlan	2.46	31.94	65.60	34.40	51.20	4.40	Dense
2691	Harlan	4.50	33.00	62.50	37.50	58.90	3.60	Pulverulent
2692	Harlan	2.50	38.60	58.90	41.10	53.04	2.40	Spongy
2693	Harlan	2.00	36.80	61.20	38.00	55.86	5.34	Light grey
2694	Harlan	2.06	37.34	60.60	39.40	52.70	2.90	Pulverulent
2695	Harlan	1.80	37.10	61.10	38.90	56.70	4.40	Light spongy
2696	Harlan	2.00	35.00	63.00	37.00	52.20	10.80	Dense
2697	Harlan	3.10	26.10	68.00	39.20	56.60	4.20	Dense
2698	Harlan	2.16	34.14	63.70	37.50	55.50	8.20	Pulverulent
2699	Harlan	1.68	32.60	62.50	37.50	58.90	3.60	Spongy
2700	Harlan	2.50	38.32	63.60	36.40	52.60	6.20	Light grey
2701	Harlan	4.64	34.38	62.20	35.00	55.00	2.40	Pulverulent
2702	Harlan	1.26	37.34	66.20	35.80	56.50	2.20	Light brownish-grey
2703	Harlan	1.56	35.04	63.40	36.60	55.20	11.00	Light brown
2704	Harlan	1.74	32.60	65.76	35.59	57.10	9.32	Light brownish-grey
2705	Harlan	1.56	35.24	63.00	36.80	58.00	5.20	Dense
2706	Harlan	1.68	32.62	62.60	37.60	56.00	2.40	Light brownish-grey
2707	Knott	1.44	33.56	65.00	35.00	55.30	9.70	Light brownish-grey
2708	Knott	1.72	44.40	54.88	45.12	54.70	2.90	Light brown
2709	Knott	1.20	37.34	69.54	36.46	58.86	12.86	Light brown
2710	Knott	1.80	36.06	61.60	38.40	58.40	8.35	Light brown
2711	Johnson	1.44	59.22	42.64	44.20	46.48	9.32	Light brownish-grey
2712	Johnson	2.56	34.14	63.70	37.30	55.50	8.20	Dense
2713	Johnson	6.48	39.94	57.50	42.50	54.10	3.40	Spongy
2714	Laurel	1.60	34.56	62.88	37.74	56.00	6.64	Light brownish-grey
2715	Laurel	2.56	34.56	62.88	37.12	55.58	3.30	Light brown
2716	Laurel	3.20	35.80	60.00	40.00	53.86	7.88	Light brown
2717	Laurel	1.20	36.70	61.10	38.90	56.88	11.00	Light brown
2718	Laurel	2.00	35.08	62.70	37.30	56.28	8.00	Light brown
2719	Laurel	1.20	35.08	63.72	36.28	58.92	4.80	Light brown
2720	Laurel	1.60	34.56	62.88	37.74	56.24	22.50	not est.
2721	Leslie	1.20	35.80	60.00	40.00	53.86	8.95	Light brown
2722	Leslie	1.72	35.52	62.60	37.90	56.70	9.60	Light brown
2723	Leslie	1.40	35.02	63.26	36.74	57.60	11.40	Light brownish-grey
2724	Leslie	2.00	35.08	63.40	36.70	56.70	11.40	Light brownish-grey
2725	Leslie	1.20	35.80	61.60	38.40	56.82	3.48	Nearly white
2726	Leslie	1.74	36.06	61.60	38.40	56.80	9.66	Light brown
2727	Leslie	0.74	36.06	63.20	36.80	54.00	9.20	Light brown
2728	Leslie	1.70	34.70	64.60	34.60	55.40	35.40	Light brownish-grey

Number	County.	Coke.	Ash.	Character of the coke.	Color of the Ash.	Specific gravity	Remarks.	
							Sulphur	Ash.
2875	Harlan	4.62	32.98	62.40	37.60	58.39	4.10	Pulverulent
2876	Harlan	6.08	32.72	61.20	38.80	58.20	3.00	Light brown
2877	Harlan	1.90	36.00	62.10	37.90	56.10	3.00	Spongy
2878	Harlan	2.02	34.94	63.60	36.40	52.70	12.30	Light salmon
2879	Harlan	1.76	34.04	60.70	36.50	54.84	3.10	Very light grey
2880	Harlan	1.60	37.70	67.80	37.80	52.92	29.60	Light spongy
2881	Harlan	1.04	21.88	77.00	22.92	52.00	47.48	Light spongy
2882	Harlan	1.50	35.30	63.20	36.80	56		

CHEMICAL REPORT.

TABLE I.—(Continued.)—COALS.—(Air Dried.)

Number	County.	Coke.	Hygroscopic moisture	Fixed carbon in the coke	Sulphur	Ash.	Character of the coke.	Color of the Ash.	Specific gravity	Remarks.
2739	Leslie	1.10	44.20	54.70	45.30	43.70	Dense	Grey-brown	not est.	Jerry Ledington's, cannel coal, Beech Fk.
2740	Leslie	1.60	34.98	62.92	56.54	58.92	Spongy	Lilac-grey	1.292	W. McFadden s., Big cr., Red Bird creek.
2741	Leslie	1.40	34.14	64.66	37.08	4.00	Light spongy	Light reddish	1.292	Richard Collins', Hals' Fork, Big creek.
2742	Leslie	1.30	32.36	66.34	33.66	50.34	Dense	Light lilac-grey	1.292	Asper's bank, Middle Fork, Ky. river.
2743	Leslie	1.30	32.36	65.00	35.00	62.44	Dense	Lilac-grey	1.302	Silas Nanitz', Oldham Br., Middle Fork.
2744	Letcher	2.40	32.60	65.20	34.80	59.08	Dense	Light salmon	not est.	Rt.-hand Br., Rt.-hand Fork, Collier's cr.
2745	Letcher	1.40	33.49	62.10	37.90	6.12	Spongy	Light grey	not est.	Wm. Lewis', Holand's Br. of Poor Fork.
2746	Martin	2.92	34.98	62.92	59.30	5.30	Dense	Light buff	1.344	Rockcastle Min. & L. Co., R'kastle cr.
2746	Martin	2.62	27.95	66.40	30.60	50.40	Friable	Light grey	1.451	Rockcastle Min. & L. Co., R'kastle cr.
2747	Perry	3.50	35.39	61.20	38.80	53.14	Dense	Light brownish-grey	1.333	John Field's coal.
2748	Perry	1.80	44.80	54.40	45.00	37.60	16.80	Grey-brown	not est.	Cannel coal, Middle Fork, Ky. river.
2749	Perry	1.20	39.60	59.20	40.80	52.70	6.50	Light lilac-grey	1.279	Wm. Boling's, Rush Br., Middle Fork.
2750	Perry	1.20	35.90	62.90	37.10	55.30	7.60	Nearly white	1.309	Wm. Boling's, Rush Br., Middle Fork.
2751	Perry	5.26	30.34	64.4c	35.60	55.20	9.20	Light purplish-grey	1.359	Fish-trap B., of North Fork of Ky. river.
2752	Perry	3.30	34.00	61.80	38.20	52.20	Dense friable	Purplish-grey	1.354	T. J. Johnson's, Ebenezer Br., Middle Fk.
2753	Perry	4.36	30.34	65.30	34.70	54.90	Friable	Very light grey	1.366	John Spencer S., Grapevine creek.
2754	Perry	3.49	31.00	65.60	34.40	55.30	10.30	Very light grey	1.366	Mouth of Guy's creek.
2755	Perry	6.43	30.32	63.20	36.30	47.80	15.40	Pulverulent	not est.	John Spencer's, Grapevine creek.
2756	Perry	2.80	29.60	67.66	32.40	58.50	9.10	Pulverulent	not est.	Joseph Campbell's, mouth Rock Lick Br.
2757	Perry	1.76	36.04	62.20	37.80	56.20	6.00	Friable	1.292	Alex. Combs', North Fork of Ky. river.
2758	Perry	3.39	32.84	63.20	36.80	52.80	10.40	Light spongy	1.300	Samuel Whitaker's, Willard creek.
2759	Perry	1.90	37.10	61.00	39.00	57.90	3.10	Purplish-grey	1.299	Peter Gross', near Squabble creek.
2760	Pulaski	2.32	32.32	62.48	65.20	34.80	59.10	Spongy	1.299	Barren Fork, nut coal.
2761	Pulaski	2.12	31.96	65.32	63.32	33.63	59.02	Yellowish-grey	not est.	Possum Branch of Wolf creek.
2762	Whitley	1.84	33.94	64.22	33.60	55.68	15.40	Pulverulent	1.393	Forks of Jellico creek, Salt Works.
2763	Whitley	2.00	31.30	66.70	33.30	62.94	3.70	Light spongy	1.285	Righ Fork of Bennett's creek.
2764	Whitley	2.40	35.80	61.80	38.20	58.90	2.84	White	1.382	Right Fork of Patterson creek.
2765	Whitley	2.14	39.76	58.10	41.90	55.06	3.04	Brownish-grey	1.279	W. Jones' coal, Briar creek.
2766	Whitley	1.97	36.10	62.00	38.00	59.50	2.50	Light brownish-grey	1.271	Henry Green's coal, Briar creek.
2767	Whitley	1.90	37.40	60.70	39.30	58.63	2.10	Spongy	1.281	Richardson's coal, Briar creek.
2768	Whitley	1.94	38.92	59.14	40.86	56.84	2.30	Spongy	1.414	M. A. Jones' coal, head of Patterson cr.
2769	Whitley	2.14	36.06	61.80	38.20	59.20	2.00	Spogny	1.262	Tackett's creek; Terrel Siler's coal.
2770	Whitley	2.40	36.60	61.00	39.00	57.70	3.30	Light brownish-grey	1.277	Mahan Station.
2771	Whitley	2.20	33.10	64.70	35.30	56.80	7.90	Dark purplish-grey	1.321	Mahan's coal, Mahan Station.
2772	Whitley	2.20	34.86	62.94	37.60	58.14	4.80	Light brownish-grey	1.271	W. M. Mahan's coal, Mahan Station.
2773	Whitley	1.80	36.70	61.50	38.59	58.59	3.00	Spongy	1.311	Caddell's coal, Wolf creek.
2774	Whitley	1.59	40.56	57.94	42.06	51.24	5.70	Dark greyish-purple	1.359	Thomas' cannel coal.
2775	Whitley	7.26	33.84	58.90	41.10	53.20	5.70	Pulverulent	1.387	

2813	Whitley	1.70	37.40	60.90	39.10	59.36	1.54	Spongy	Light purplish-grey	1.263	Lower part of Creedmore coal.
2814	Whitley	2.24	35.66	62.10	37.90	58.76	3.34	Light spongy	Salmon	1.241	B. P. Shelly's coal, upper 26 inches.
2815	Whitley	2.58	33.12	64.30	35.70	62.70	1.60	Light spongy	Light brown	1.293	Wagster Sier's, on Mud creek.
2816	Whitley	2.00	34.82	63.18	36.82	60.48	2.70	Light spongy	Light brownish-grey	not est.	J. S. Berry's, Jellico seam.

WEST VIRGINIA COALS.—(Air Dried)

Number	County.	Coke.	Hygroscopic moisture	Fixed carbon in the coke	Sulphur	Ash.	Character of the coke.	Color of the Ash.	Specific gravity	Remarks.	
2818	Wise	0.86	38.54	60.60	47.84	12.76	Dense friable	Chocolate brown	not est.	Three miles above mouth of Preacher cr.	
2819	Fayette	.40	18.00	81.60	2.60	.491	Light inflated	Light buff-grey	not est.	Quinnimont mines.	
2820	Fayette	.60	20.80	78.66	21.40	75.34	4.18	Light spongy	Light buff-grey	not est.	Fire creek.
2821	Fayette	.60	22.86	76.66	23.40	74.20	2.40	Light spongy	Light buff-grey	not est.	Stone Cliff.
2822	Fayette	.90	19.10	80.00	20.00	73.66	6.40	Light spongy	Light buff-grey	not est.	Sewell, on top of the conglomerate.
2823	Fayette	.80	22.14	77.06	22.94	74.16	2.60	Light inflated	Light brownish-grey	not est.	
2824	Fayette	1.06	32.34	66.60	33.40	62.00	4.60	Spongy	Light buff-grey	not est.	Hawkest.

CHEMICAL REPORT.

APPENDIX.

TABLE I.—COMPOSITION OF COALS.—(Air Dried.)—Continued.

440

140

CHEMICAL REPORT.

141

CHEMICAL REPORT.

Number	County.	Hygroscopic moisture	Volatile combustible matters	Coke.	Carbon in coke.	Ash.	Character of the coke.	Color of the Ash.	Sulphur	Remarks.	
										5.30	5.30
2833	Bell	1.40	37.10	61.50	38.50	56.30	Dense spongy.	Brown	1.151	John Slusher's, Straight creek.	
2834	Bell	.60	35.00	64.40	35.00	55.60	Very dense.	Light grey-brown	1.068	James Green's coal.	
2835	Bell	1.20	32.20	66.00	33.40	61.60	Inflated.	Brownish-grey	.574	James Green's coal.	
2836	Bell	1.00	35.40	63.00	36.40	61.70	Inflated.	Light salmon-colored	.620	James Green's coal.	
2837	Bell	1.70	32.00	65.70	34.30	63.30	Spongy.	Light grey-brown	.684	Fifteen miles above Pineville.	
2838	Bell	1.03	31.60	47.40	52.60	40.40	Dense.	Brown	.739	Fifteen miles above Pineville.	
2839	Bell	.80	33.00	65.30	34.70	59.90	5.40	Light spongy.	1.568	James Bissell's, Cannon creek.	
2840	Bell	5.40	39.00	64.60	35.40	60.50	4.10	Pulverulent.	.439	Feehan Risner's coal, on Brownie's creek.	
2841	Bell	1.60	47.40	51.00	49.00	47.70	3.30	Dark salmon-colored.	.574	Head of Middle Fork, Williams Br. Yellow creek.	
2842	Bell	1.60	33.20	65.20	34.80	60.60	4.00	Light spongy.	.876	Head of Middle Fork, Williams Br. Yellow creek.	
2843	Bell	1.40	32.30	66.30	33.70	63.50	2.80	Light grey-brown.	.670	On land of J. M. Robbins, Crane creek of Yet low creek.	
2844	Bell	1.20	34.90	63.90	36.10	62.10	1.80	Spongy.	.529	John M. Maricle's, Cublog creek.	
2845	Bell	1.00	35.30	63.90	36.10	60.20	3.70	Light grey-brown.	.423	Richard Risner's, Hansie's creek.	
2846	Bell	2.20	32.60	65.20	34.80	61.80	3.40	Salmon-colored.	.601	Andrew Maricle's, Cublog creek.	
2847	Bell	4.10	29.90	66.00	34.00	61.80	4.20	Dense friable.	.739	Shade Branch of Bennett's Fork, Cublog creek.	
2848	Bell	2.60	33.20	64.00	35.80	59.60	4.00	Dense spongy.	.931	Stone Coal Branch of Brownie's creek.	
2849	Bell	1.40	34.00	64.00	36.00	61.80	2.20	Dark salmon-colored.	.821	Near head of Brownie's creek.	
2850	Bell	2.00	34.00	63.00	36.00	60.40	3.00	Dense.	.965	Head of Steward's Branch.	
2851	Bell	4.40	29.50	66.10	33.90	59.50	5.60	Very dense.	.587	Above head of Kit Island Branch of Straight cr.	
2852	Bell	4.60	28.80	66.60	33.40	63.60	3.00	Pulverulent.	.928	Head of Catterer's creek of Martin's Fork.	
2853	Bell	7.60	28.94	63.46	36.54	55.26	8.20	Pulverulent.	.506	Head of Bell's Branch of Catterer's creek.	
2854	Bell	1.44	32.56	66.00	34.00	53.34	12.66	Dense spongy.	.603	On Four-mile creek.	
2855	Bell	6.70	30.10	63.20	36.80	53.40	13.49	Pulverulent.	.1.454	On Four-mile creek.	
2856	Bell	0.39	29.76	60.26	30.06	55.74	14.20	Dense.	.1.125	Head of Steward's Branch.	
2857	Bell	1.40	35.34	60.60	36.74	60.26	3.00	Inflated.	.2.965	Head of Steward's Branch.	
2858	Harlan	3.00	31.40	65.60	34.40	56.30	9.30	Dense.	.568	Above head of Kit Island Branch of Straight cr.	
2859	Harlan	1.66	42.80	55.54	44.46	35.44	22.10	Light buff-grey.	.604	Head of Luna's creek.	
2860	Harlan	1.86	30.74	67.40	32.60	65.50	2.40	Light grey-brown.	.549	Head of Catterer's creek of Martin's Fork.	
2861	Harlan	1.74	33.32	64.94	35.66	59.24	5.70	Spongy.	.493	Head of Bell's Branch of Catterer's creek.	
2862	Harlan	2.50	33.90	65.40	34.49	61.86	3.80	Light brown.	.438	Catterer's creek of Martin's Fork.	
2863	Harlan	1.80	37.30	61.90	38.10	54.90	7.00	Purplish-brown.	.925	Two lower seams, same bed.	
2864	Harlan	1.60	32.00	66.60	33.40	62.30	4.30	Light brown.	.712	Trace Branch of Clover creek.	
2865	Harlan	3.60	29.40	67.00	33.00	57.00	10.00	Pulverulent.	.425	Slick Rock Branch of Clover creek.	
2866	Harlan	1.40	34.00	67.00	33.00	57.00	10.00	Inflated.	.577	Terry's Branch of Wallen's creek.	

Number	County.	Hygroscopic moisture	Volatile combustible matters	Coke.	Carbon in coke.	Ash.	Character of the coke.	Color of the Ash.	Sulphur	Remarks.	
										5.30	5.30
2872	Hardin	.90	30.10	69.00	31.00	42.40	26.60	Dense friable.	1.084	Terry's Branch of Wallen's creek.	
2873	Hardin	4.00	31.00	65.00	35.00	56.00	9.00	Friable.	1.027	Head of Puckett's creek.	
2874	Hardin	2.40	34.20	63.40	36.60	60.60	2.80	Grey-brown.	.564	Head of Puckett's creek.	
2875	Hardin	1.80	34.20	64.00	36.00	60.10	3.90	Dense spongy.	.517	Head of Puckett's creek.	
2876	Hardin	2.00	33.40	64.60	35.40	61.60	3.00	Very dense.	.917	Martin's Fork of Cumberland river.	
2877	Hardin	1.10	33.90	66.00	35.00	63.40	2.60	Dark salmon-colored.	.519	Black Mountain, Martin's Fork, Camb'r'd river.	
2878	Hardin	1.20	33.00	65.80	34.20	61.80	4.00	Dense spongy.	.628	Broad Branch of Martin's Fork.	
2879	Hardin	1.20	33.00	63.70	36.30	57.10	6.60	Grey-purplish.	.629	On Crunkie's Branch of Martin's Fork.	
2880	Hardin	3.20	33.00	63.20	36.80	56.50	6.40	Dense.	.996	On G. W. Smith's land, Crunkie's creek.	
2881	Hardin	2.80	32.00	62.00	34.80	58.80	2.40	Light brown.	.354	On Crunkie's creek.	
2882	Hardin	1.80	31.60	60.20	30.80	61.10	8.10	Light brown.	.486	Cold Iron Branch of Poor Fork, Cumb'land river.	
2883	Hardin	2.30	28.00	68.74	31.26	60.44	8.30	Light brown.	.547	Head of Camp Fork, Luna's creek.	
2884	Hardin	2.15	32.00	63.50	34.00	61.60	3.00	Light brownish-grey.	.574	Head of Rockhouse Branch of Luna's creek.	
2885	Hardin	2.20	33.80	65.80	34.20	61.80	4.00	Very light brown.	.552	Near mouth of Luna's creek.	
2886	Hardin	5.70	32.00	63.70	36.30	57.10	6.60	Light brown.	.425	Near mouth of Luna's creek.	
2887	Hardin	9.60	33.00	63.20	36.80	56.80	6.40	Pulverulent.	.560	Near mouth of Luna's creek.	
2888	Hardin	1.80	31.60	66.00	33.40	58.80	10.08	Nearly white.	.425	Cold Iron Branch of Poor Fork, Cumb'land river.	
2889	Hardin	2.40	31.70	65.90	34.10	63.70	3.40	Light brown.	.581	Head of Camp Fork, Luna's creek.	
2890	Knox	3.15	31.50	63.50	33.80	61.60	4.00	Dense spongy.	.512	Turkey Pen Branch, Poor Fork.	
2891	Knox	4.40	37.20	62.40	37.60	56.40	5.94	Light spongy.	.566	Golden Fork of Poplar creek.	
2892	Knox	3.40	33.80	62.80	37.20	58.80	4.00	Dense spongy.	.820	S. W. Owlesley's coal.	
2893	Whitley	2.46	34.14	63.14	36.66	55.80	5.60	Light brownish-grey.	.930	Near Siley; bed 16 inches thick.	
2894	Whitley	1.60	34.24	64.40	35.60	56.80	7.00	Light brownish-grey.	.923	Camel coal (1) near western border of county.	
2895	Whitley	2.00	33.70	64.30	35.70	61.90	2.40	Light brownish-grey.	.848	On Harp's creek; Bennett's coal; upper 2 feet.	
2896	Whitley	2.60	33.20	64.20	35.80	62.30	2.00	Light brownish-grey.	.820	Procter Company coal mine, whole bed.	
2897	Whitley	1.80	35.00	63.20	36.80	60.60	2.60	Very lit, brownish-grey.	.769	Procter Company coal mine, lower seam.	
2898	Whitley								.714	Procter Company coal mine, upper bench.	

TENNESSEE COALS.—(Air Dried.)

Number	County.	Hygroscopic moisture	Volatile combustible matters	Coke.	Carbon in the coke.	Ash.	Character of the coke.	Color of the Ash.	Sulphur	Remarks.	
										5.30	5.30
2905	Claiborne	2.10	34.24	63.66	36.34	55.26	8.40	Dense spongy.	1.427	Head of Little Coal Branch of Tackett's creek.	
2906	Claiborne	7.00	30.90	62.10	37.90	58.30	3.80	Light brownish-grey.	.685	Mouth of Big Sugar Branch of Bennett's Fork.	

CHEMICAL REPORT.

TABLE II.—COKES.—(Air Dried.)

Number . . .	County.	Sulphur . . .	Color of the Ash.	Owner of the Coal.	Hours of coking . . .	Remarks.
	Carbon in the coke . . .	Ash. . .				
2589	Bell . . .	0.80	93.90	5.30	1.480	Made at Birmingham, Alabama.
2590	Bell . . .	.20	95.80	4.00	1.710	Made at Quinimont, West Virginia.
2591	Bell . . .	.50	94.50	5.00	1.590	Made at Quinimont, West Virginia.
2592	Bell . . .	1.80	87.20	11.00	1.343	Made at Birmingham, Alabama.
2593	Bell . . .	.60	87.80	11.60	1.590	Made at Quinimont, Alabama.
2594	Bell . . .	.40	89.20	10.40	1.590	Made at Quinimont.
2595	Bell . . .	1.30	88.90	9.80	1.346	Made at Quinimont.
2596	Bell . . .	2.40	85.30	12.30	1.543	Made at Birmingham, Alabama.
2597	Bell . . .	.40	90.80	8.80	.547	Made at Quinimont, West Virginia.
2598	Bell . . .	.10	91.50	8.49	.744	Made at Quinimont, West Virginia.
2599	Bell . . .	.20	94.20	5.60	.604	Made at Birmingham, Alabama.
2600	Bell . . .	1.60	89.60	8.80	.494	Made at Birmingham, Alabama.
2601	Bell . . .	.70	92.70	6.60	.450	Made at Birmingham, Alabama.
2602	Bell . . .	.26	94.00	5.60	.629	Made at Quinimont, West Virginia.
2603	Bell . . .	.66	92.94	6.80	1.033	Made at Birmingham, Alabama.
2604	Bell . . .	.20	90.54	8.80	1.150	Made at Quinimont, West Virginia.
2605	Bell . . .	.100	92.80	7.60	.491	Made at Quinimont, West Virginia.
2606	Bell . . .	1.00	92.80	6.20	.663	Made at Quinimont, West Virginia.
2607	Bell . . .	.40	92.70	6.40	.975	Made at Quinimont, West Virginia.
2608	Bell . . .	1.80	90.50	7.70	.684	Made at Quinimont, West Virginia.
2711	Harien . . .	.60	93.10	6.30	.546	Made at Quinimont, West Virginia.
2712	Harien . . .	1.34	88.76	17.90	.648	Made at Quinimont, West Virginia.
2713	Harien . . .	.40	93.00	6.00	1.068	Made at Quinimont, West Virginia.
2714	Harien . . .	.90	92.90	6.20	.368	Made at Quinimont, West Virginia.
2725	Knox . . .	.90	95.90	3.20	.546	Made at Quinimont, West Virginia.
2726	Knox . . .	.40	93.70	5.90	.478	Made at Quinimont, West Virginia.
2727	Knox . . .	.50	96.00	3.50	.217	Made at Quinimont, West Virginia.
2728	Knox . . .	.90	99.70	8.40	.546	Made at Quinimont, West Virginia.
2730a	Laurel . . .	.50	92.60	6.90	.615	Made at Quinimont, West Virginia.
2746	Lecher . . .	.70	80.30	10.80	.863	Made at Quinimont, West Virginia.
2817	Whitley . . .	1.50	93.30	5.20	.382	Made at Quinimont, West Virginia.

TABLE II.—(Continued.)—WEST VIRGINIA COKES.—(Air Dried.)

Number . . .	County.	Sulphur . . .	Color of the Ash.	Kind of Coal.	Hours of coking . . .	Remarks.
	Carbon in the coke . . .	Ash. . .				
2825	Fayette . . .	2.20	92.00	5.80	0.491	Brownish-grey . . .
2826	Fayette . . .	1.40	90.50	9.10	.711	Light grey-brown . . .
2827	Fayette . . .	1.70	92.90	5.40	.404	Brownish-grey . . .
2828	Fayette . . .	.86	92.74	6.40	.437	Light buff-grey . . .
2829	Fayette . . .	.36	96.40	3.24	.519	Light reddish-brown . . .
2830	Fayette . . .	1.60	89.80	8.60	.821	Light grey-brown . . .
2831	Fayette . . .	.50	92.90	6.60	.560	Light brownish-grey . . .
2832	Fayette . . .	1.60	91.80	6.60	.478	Light brown-grey . . .

APPENDIX.

TABLE V.—IRON ORES.—(Air Dried.)

Number . . .	County.	Iron peroxide . . .	Alumina . . .	Lime carbonate . . .	Magnesia carbonate . . .	Phosphoric acid (P_2O_5) . . .	Silica . . .	Water expelled at $212^{\circ}F.$. . .	Per cent. iron . . .	Carbonic acid, water, &c. . .	Per cent. iron . . .	Remarks.
2899	Muhlenberg . . .	0.20	90.20	9.60	1.260	Purplish-grey . . .				Made from coal three-quarters of a mile northwest of Mud River coal mines.		
2899	Bell . . .	60.517	5.723	traces.	1.202	23.940	1.143	10.863	33.341	Clinton group ore, Captain W. G. Allen's property.		
2899	Harien . . .	44.200	9.080	13.080	9.444	7.800	.693	11.283	36.001	Clinton group ore, from land of Purvis lands.		
2901	Pike . . .	66.370	12.270	15.160	4.528	1.010	6.960	1.607	40.999	On N. face of Pine Mt., $3\frac{1}{2}$ miles E. of Pineville, $6\frac{1}{2}$ in. Oriskany ore.		
2901	Pike . . .							15.520	46.464	On Poor Fork of Cumberland river, 27 miles above Harlan Court-house.		
2901	Pike . . .									Collected by C. M. Parsons		

CHEMICAL REPORT.

TABLE III.—SOILS AND SUBSOILS.—(Calculated Dried at 212° F.)

Number	County.	Fine sand.	Soda in siliceous residue.	Potash in siliceous residue.	Hygroscopic moisture	Sand and insoluble silicates	Water expelled at 380°-400° F.	Soda	Potash	Phosphoric acid (P ₂ O ₅)	Magnesia	Lime carbonate	Iron peroxide	Alumina and manganese oxide	Organic and volatile matters
2556	Ballard	3.306	2.945	1.860	0.196	.181	.068	.477	.389	0.556	1.263	8.3-99	1.100	1.497	0.834
2557	Ballard	5.272	6.836	4.124	.210	.273	.226	.73	.145	.425	.941	8.6-85	2.29	1.099	12.500
2558	Ballard	4.635	4.217	1.915	1.403	.134	.062	.420	.110	.085	.197	1.175	1.435	1.243	n. e.
2559	Ballard	3.496	3.005	1.997	.996	.134	.062	.420	.110	.085	.197	1.175	1.435	1.243	n. e.
2560	Ballard	2.079	4.613	.971	.202	.252	.052	.420	.110	.085	.197	1.175	1.435	1.243	n. e.
2561	Ballard	3.642	4.639	2.393	.071	.198	.103	.295	.248	.425	.953	8.7-95	1.430	1.229	1.032
2562	Ballard	2.114	4.553	3.977	.046	.344	.115	.422	.136	.422	.886	8.8-86	1.375	1.180	1.228
2563	Ballard	3.510	3.966	2.112	.146	.280	.100	.419	.260	.136	.883	8.8-86	1.375	1.180	1.228
2564	Ballard	2.364	4.662	2.870	.086	.222	.126	.674	.110	.230	.866	8.8-86	1.300	1.415	.257
2565	Ballard	1.961	1.997	1.403	.071	.124	.094	.250	.236	.236	.660	1.235	1.386	n. e.	n. e.
2566	Ballard	3.733	2.130	1.519	.349	.175	.065	.265	.057	.164	.953	9.3-385	.997	.567	44.050
2567	Ballard	1.233	3.268	2.224	.046	.244	.106	.078	.169	.078	.824	8.9-353	1.300	1.859	1.025
2568	Calloway	3.475	3.612	2.116	.021	.180	.062	.151	.097	.755	.863	8.6-342	1.125	1.264	3.374
2569	Calloway	6.080	8.171	4.791	.280	.461	.124	.310	.110	.100	.834	8.3-432	1.450	1.146	.535
2623	Calloway	3.549	3.190	2.862	.096	.125	.093	.084	.119	.096	.866	8.8-86	1.150	1.572	1.533
2624	Calloway	2.632	5.239	4.334	.096	.124	.093	.084	.119	.096	.866	8.6-166	1.250	1.378	1.331
2625	Calloway	2.569	3.347	2.968	trace	.089	.062	.399	.110	.096	.866	8.9-353	1.300	1.859	1.025
2626	Calloway	4.990	4.445	3.268	.046	.215	.062	.151	.097	.755	.863	8.6-342	1.125	1.264	3.374
2627	Calloway	5.482	5.395	3.060	.021	.147	.024	.146	.110	.096	.834	8.3-432	1.450	1.146	.535
2628	Calloway	2.687	5.333	4.365	.220	.183	.124	.310	.110	.100	.834	8.3-432	1.450	1.146	.535
2629	Calloway	3.300	4.395	3.711	.096	.146	.217	.094	.238	.029	.834	8.8-86	1.150	1.572	1.533
2630	Calloway	2.497	1.924	2.020	.131	.118	.126	.094	.235	.035	.669	8.6-522	1.650	1.866	1.424
2631	Calloway	2.999	4.725	4.250	.041	.273	.094	.256	.110	.096	.866	8.7-95	1.150	1.572	1.274
2632	Calloway	2.659	1.689	2.564	.652	.176	.062	.076	.068	.668	.657	9.1-345	1.150	1.990	1.455
2633	Calloway	2.188	2.859	2.836	.096	.153	.094	.127	.110	.096	.834	8.4-356	1.300	1.993	1.3150
2634	Calloway	5.848	4.982	4.982	.046	.215	.062	.151	.097	.755	.863	8.6-342	1.125	1.264	3.374
2635	Calloway	3.500	4.332	5.575	.132	.364	.124	.246	.110	.096	.834	8.3-432	1.450	1.146	.535
2636	Calloway	3.667	3.533	4.365	.220	.183	.124	.310	.110	.096	.834	8.3-432	1.450	1.146	.535
2637	Calloway	3.499	4.395	3.711	.096	.146	.217	.094	.238	.029	.834	8.8-86	1.150	1.572	1.533
2638	Calloway	2.497	1.924	2.020	.131	.118	.126	.094	.235	.035	.669	8.6-522	1.650	1.866	1.424
2639	Calloway	3.511	2.484	3.795	.147	.235	.094	.256	.110	.096	.866	8.7-95	1.150	1.572	1.274
2716	Jefferson	5.100	10.324	3.795	.140	.458	.176	.191	.201	.100	.789	7.8-950	1.790	1.855	1.418
2747	Marshall	3.443	3.303	1.955	.025	.162	.136	.047	.110	.067	.667	9.0-990	1.300	1.544	1.418
2748	Marshall	2.373	5.041	2.030	trace	.139	.110	.515	.110	.227	.888	8.7-877	1.400	.515	1.3150
2749	Marshall	3.757	3.706	1.366	.026	.143	.109	.083	.210	.583	.909	1.520	1.438	.402	3.725
2750	Marshall	3.845	4.623	3.039	.076	.181	.127	.094	.238	.024	.834	8.4-446	1.700	1.386	.588
2751	Marshall	3.659	4.875	4.750	.046	.194	.113	.192	.110	.096	.834	8.4-446	1.700	1.386	.588
2752	Marshall	3.506	3.030	2.937	trace	.261	.110	.305	.046	.531	.834	8.4-446	1.700	1.386	.588
2753	Marshall	4.411	4.448	3.395	trace	.344	.094	.166	.110	.590	.834	8.4-446	1.700	1.386	.588
2754	Marshall	2.949	3.671	2.077	.046	.226	.046	.117	.096	.557	.866	8.6-678	1.400	1.614	1.5150
2755	Marshall	2.330	4.937	2.667	.046	.327	.014	.079	.048	.094	.974	8.9-452	1.303	1.434	.542
2756	Marshall	2.129	3.875	2.930	.045	.309	.096	.179	.179	.045	.794	8.9-453	1.300	1.462	.439

Soda

Potash

Phosphoric acid (P₂O₅)

Magnesia

Lime carbonate

Iron peroxide

Alumina and manganese oxide

Organic and volatile matters

Hygroscopic moisture

Sand and insoluble silicates

Water expelled at 380°-400° F.

Soda in siliceous residue

Potash in siliceous residue

Phosphoric acid (P₂O₅) in siliceous residue

Magnesia in siliceous residue

Lime carbonate in siliceous residue

Iron peroxide in siliceous residue

Alumina and manganese oxide in siliceous residue

Organic and volatile matters in siliceous residue

Hygroscopic moisture in siliceous residue

Sand and insoluble silicates in siliceous residue

Water expelled at 380°-400° F. in siliceous residue

Soda in clay

Potash in clay

Phosphoric acid (P₂O₅) in clay

Magnesia in clay

Lime carbonate in clay

Iron peroxide in clay

Alumina and manganese oxide in clay

Organic and volatile matters in clay

Hygroscopic moisture in clay

Sand and insoluble silicates in clay

Water expelled at 380°-400° F. in clay

Soda in loam

Potash in loam

Phosphoric acid (P₂O₅) in loam

Magnesia in loam

Lime carbonate in loam

Iron peroxide in loam

Alumina and manganese oxide in loam

Organic and volatile matters in loam

Hygroscopic moisture in loam

Sand and insoluble silicates in loam

Water expelled at 380°-400° F. in loam

Soda in loamy soil

Potash in loamy soil

Phosphoric acid (P₂O₅) in loamy soil

Magnesia in loamy soil

Lime carbonate in loamy soil

Iron peroxide in loamy soil

Alumina and manganese oxide in loamy soil

Organic and volatile matters in loamy soil

Hygroscopic moisture in loamy soil

Sand and insoluble silicates in loamy soil

Water expelled at 380°-400° F. in loamy soil

Soda in clay loam

Potash in clay loam

Phosphoric acid (P₂O₅) in clay loam

Magnesia in clay loam

Lime carbonate in clay loam

Iron peroxide in clay loam

Alumina and manganese oxide in clay loam

Organic and volatile matters in clay loam

Hygroscopic moisture in clay loam

Sand and insoluble silicates in clay loam

Water expelled at 380°-400° F. in clay loam

Soda in loamy soil

Potash in loamy soil

Phosphoric acid (P₂O₅) in loamy soil

Magnesia in loamy soil

Lime carbonate in loamy soil

Iron peroxide in loamy soil

Alumina and manganese oxide in loamy soil

Organic and volatile matters in loamy soil

Hygroscopic moisture in loamy soil

Sand and insoluble silicates in loamy soil

Water expelled at 380°-400° F. in loamy soil

Soda in clay loamy soil

Potash in clay loamy soil

Phosphoric acid (P

TABLE IV.—CLAYS.—(Air Dried.)

Number . . .	County.	Remarks.	
2568	Ballard . . .	74.840	16.580
2569	Ballard . . .	71.186	20.880
2570	Ballard . . .	76.510	14.820
2571	Ballard . . .	63.810	20.010
2572	Ballard . . .	44.840	22.830
2573	Ballard . . .	73.240	15.760
2638	Calloway . . .	87.300	10.480
2639	Calloway . . .	46.620	38.986
2640	Calloway . . .	61.680	28.500
2641	Calloway . . .	56.680	29.700
2642	Calloway . . .	66.380	16.480
2643	Calloway . . .	57.840	30.340
2644	Calloway . . .	54.140	32.140
2645	Calloway . . .	54.400	29.440
2662	Graves . . .	76.780	14.740
2663	Graves . . .	62.680	27.880
2664	Graves . . .	73.120	15.960
2665	Graves . . .	61.020	30.260
2666	Graves . . .	56.080	32.160
2715	Hickman . . .	83.186	10.266
2739	Marshall . . .	84.580	10.650
2766	Marshall . . .	52.580	31.070
2767	Marshall . . .	91.580	5.980
2768	Marshall . . .	60.980	13.480
2773	Marshall . . .	62.920	29.886
2764	McCracken . . .	93.700	3.580
2777	McCracken . . .	59.500	24.960
2778	McCracken . . .	66.320	22.930
2779	McCracken . . .	67.580	20.040
2780	McCracken . . .	69.420	17.540
2781	McCracken . . .	73.192	16.540

Fine sand

Water and loss. . . .

Soda

Potash

Magnesia

Lime

Iron peroxide

Alumina

Silica

weathered coal would give a spongy or cellular coke—and presenting more ash material than belongs to the unaltered coal of the interior of the bed.

For comparison with these Kentucky coking coals, I have appended, in the following table of average compositions, the composition of a Connellsville, Pennsylvania, coal, which is used at a large number of coke ovens, from a recent analysis, reported by Joseph D. Weeks—"MINERAL RESOURCES OF THE UNITED STATES," calendar year 1885, page 99—in the following table of comparison of our Kentucky coals.

Excluding from the list of Bell and Harlan coals given in this Appendix, all samples of cannel coal, and all which left more than 7 per cent. of ash, as being unfit for coking, the result is as follows:

AVERAGE COMPOSITION OF THE COKING COALS OF BELL AND HARLAN COUNTIES.—(Air Dried.)

Percentages of	Fixed carbon.	Volatile matters.	Ash.	Sulphur.
In 19 Bell county coals	60.81	35.35	3.45	0.779
In 19 Harlan county coals	61.00	33.06	3.82	.823
Averages of these 38 Kentucky coals.	60.90	34.20	3.64	.801
Average of Connellsville coal	60.30	31.38	7.24	1.090

No doubt these coals would generally yield coke of very superior quality.

The highest proportions of sulphur in these fifty-two Bell and Harlan county coals was found in Nos. 2879 and 2880 of Harlan, and 2839 of Bell, being severally 1.906, 1.782, and 1.508 per cent.

Of the Bell and Harlan county coals, the compositions of which are given in the first part of Report, probably not more than one-half are good coking coals.

ADDENDA.

Since the preceding report was placed in the hands of the printer the following analyses were made, which, by advice of Mr. Procter, Director of the Survey, are added, as "Addenda."

BELL COUNTY—(Continued.)

No. 2910—COAL. *Kettle Island Branch of Straight creek, Cumberland river, half a mile from the mouth of the creek. Land of Abe Lock.* Geological position: 1st Coal ? Average sample from the 46-inch face. Collected by A. R. Crandall, July 24, 1888.

A pure-looking, pitch-black coal, breaking, generally, imperfectly cuboidal and irregular, with shining irregular surfaces. Very little fibrous coal or pyrites apparent.

COMPOSITION.—(Air Dried.)

	Per cent.	Per cent.
Hygroscopic moisture	0.20	
Volatile combustible matters	38.40	38.60
Much inflated coke	61.40	57.80
		3.60
	100.00	100.00
Percentage of sulphur	1.757	

A very good coal, containing rather more volatile combustible matters than the very best coking coal, which would make good coke, which would contain rather more than the best average of sulphur.

No. 2910a—COAL, in the approach to Cumberland Gap, Bell county. Geological position: inter-conglomerate. Bed varying in thickness from two feet four inches to two feet seven inches. Collected by John R. Procter, August, 1888.

A pure-looking semi-cannel or splint coal.

COMPOSITION.—(Air Dried.)

	Per cent.	Per cent.	
Hygroscopic moisture	1.00	Total volatile matters	34.20
Volatile combustible matters	33.20	Fixed carbon in the coke	63.60
Spongy coke	65.80	Light reddish-brown ash	2.20
	<hr/> 100.00	<hr/> 100.00	
Percentage of sulphur	<hr/> 0.549		

A remarkably pure, good coal, which would make very good coke.

BRECKINRIDGE COUNTY.

No. 2911—COAL sent by A. Inglis, Breckinridge Cannel Coal Company, Cloverport, Kentucky, August 17, 1888.

COMPOSITION.—(Air Dried.)

	Per cent.	Per cent.	
Hygroscopic moisture	6.30	Total combustible matters	46.80
Volatile combustible matters	40.50	Fixed carbon in the coke	47.88
Dense spongy coke	53.20	Light greyish-brown ash	5.32
	<hr/> 100.00	<hr/> 100.00	
Percentage of sulphur	<hr/> 2.320		

A very good semi-cannel coal. It contains, however, rather large proportion of sulphur.

No. 2912—A, B, C and D. “BITUMINOUS SANDSTONES.” (Sand saturated with petroleum.)

SAMPLE A.—Ten miles south of Grayson Springs, Grayson county. Base of the conglomerate. Collected by Edward Orton, August, 1888.

SAMPLE D.—From same locality. Collected by Edward Orton. Ten feet thick. Base of the conglomerate.

SAMPLE B.—From near Elizabethtown, Hardin county. From base of the conglomerate. Collected by Moritz Fischer.

SAMPLE C.—From land of John Richards, Carter county. Tough, pasty, black masses of sand penetrated by petro-

leum, some of which, extracted by gasoline and ether, appeared of the ordinary consistence of rather dense rock oil.

Proportions of petroleum as determined by combustion:

In sample A=9.40 per cent.
In sample B=8.75 per cent.
In sample C=8.50 per cent.
In sample D=8.00 per cent.

CALDWELL COUNTY.

No. 2913—IRON ORE, limonite, from “Stone Farm,” two and a half miles north of Princeton, Caldwell county. Geological horizon: St. Louis. Sample collected by C. C. Genung.

A hard, generally dark brown, dense limonite, with very little ochreous ore. Only the iron, silica and phosphorus determined, in the air-dried ore, which were as follow:

Percentage of iron, =54.510.
Percentage of silica, = 7.600.
Percentage of phosphorus= .279.

A very good, rich iron ore.

CHRISTIAN COUNTY.

No. 2914—MINERAL WATER. From a bored well on the farm of J. S. McCarley, one and a half miles from Hopkinsville, on the L. & N. R. R. Called “Blue Lick Water” or “Green Lick.” This water was struck at the depth of one hundred feet, and petroleum was found in small quantities in several of the strata passed through.

The water is said to be “perfectly clear” when first taken out of the well, but it soon becomes turbid, deposits a sediment of a dark color, and of a bituminous character.

It contains 1.07 per cent. of solid matters, mostly saline, with some sulphurous and nitrogenous organic matters; also much hydrogen sulphide gas, with a little carbonic acid gas.

Its saline contents are, namely: Lime and magnesia sulphates; sodium chloride (common salt); lime and magnesia carbonates, and traces of iron and alkaline carbonates.

CRITTENDEN COUNTY.

No. 2915—MINERAL WATER, from "Crittenden County Sulphur Spring," four miles west of Marion.

This water contains a notable quantity of hydrogen sulphide gas, with some carbonic acid gas. One thousand grains of the water left only 0.44 of a grain of saline matters on evaporation at 212° F.

These consist mainly of sodium chloride and magnesium sulphate, with small traces of iron, lime, potash and lithium salts.

It is a pure but weak "white sulphur" water, which might, no doubt, be advantageously used as a medicinal agent.

JEFFERSON COUNTY.

No. 2916—MINERAL WATER, from depth of 1,900 feet in the well, bored for natural gas, on the property of S. E. Edmunds, on the west side of Third street, between Weissinger and Magnolia streets, Louisville, named "St. Patrick's Well." The water is called "magnetic water."

The well flows two gallons per minute, out of very hard rock, as white as marble. Combustible gas flows out with the water, enough to supply several burners in the structure where the water is dispensed.

Qualitative analysis showed the presence of hydrogen sulphide, a trace of hydrogen carbide, and carbonic acid gases.

It contains, in solution, a considerable proportion of sodium chloride (common salt); also chlorides and sulphates of calcium and magnesium, notable traces of lithium and potassium salts, and some little of acid carbonates of lime and magnesia held in solution by the carbonic acid.

One hundred cubic centimeters of the water, evaporated to dryness at the temperature of 212°, left 1.829 grammes of these saline matters.

As the cork of the jug containing the water had been tampered with and broken in its transit from the well, the gases of the water had mainly escaped before it reached the laboratory.

The magnetic properties of this water, like those of the once celebrated magnetic springs of Michigan, belong to the iron tubing, which is polarized by the earth's magnetism, and not to the water.

KNOX COUNTY.

No. 2917—COAL, from near Gray's Station, North Jellico Mines, Knox county. An average sample from the whole face of the 45 inch bed, taken 65 feet in the entry. Collected by A. R. Crandall, August 2d, 1888.

A bright, pure-looking, pitch-black, soft coal, breaking large cuboidal and irregular, with irregular, shining surfaces. Very little mineral charcoal or pyrites apparent.

COMPOSITION.—(Air Dried.)

	Per cent.	Per cent.	
Hygroscopic moisture	1.20	Total volatile matters	36.60
Volatile combustible matters	35.40	Fixed carbon in the coke	60.00
Spongy coke	63.40	Light brownish-grey ash	3.40
	100.00		100.00
Percentage of sulphur	1.043		

LAUREL COUNTY.

No. 2918—COAL, from near Lily. Bed six feet thick. Sample collected by Dr. L. H. Blanton, April, 1888.

A pure-looking, jet-black coal, imperfectly laminated, breaking, generally, with irregular shining surfaces. Bird's-eye structure in some pieces. A little fibrous coal apparent.

COMPOSITION.—(Air Dried.)

	Per cent.	Per cent.	
Hygroscopic moisture	2.40	Total volatile matters	37.90
Volatile combustible matters	35.50	Fixed carbon in the coke	58.30
Spongy coke	62.10	Nearly white ash	3.80
	100.00		100.00
Percentage of sulphur	0.961		

A remarkably good and pure "semi-cannel" or "splint" coal, which would make very good coke.

LOGAN COUNTY.

No. 2919—MINERAL WATER, from a "sulphur well," on the premises of the "Logan County Female College," Russellville, Kentucky.

On qualitative analysis, this water was found to contain: Carbonic acid gas with a trace of hydrogen sulphide; small quantities of lime and magnesia acid carbonates; traces of potash and soda carbonates, and small proportions of sulphates and chlorides of these bases.

The total amount of saline matters in 100 cubic centimeters of this water, dried at 212° F., was only 0.044 gramme. It is quite a pure, soft, weak sulphur water.

No. 2919a—MINERAL WATER, from a well 163 feet deep, Geo. R. Beall's, near Russellville, Logan county. Geological position: Lower St. Louis.

By qualitative analysis, it was found to contain hydrogen sulphide and carbonic acid gases.

On evaporation it left of saline matters, dried at 212° F., 2.69 parts to the 1000. of the water. These were found to consist of chlorides of sodium, potassium, with a trace of lithium; the sodium chloride (common salt) being in largest proportion; also small proportions of magnesia and lime sulphates and carbonates.

It may be characterized as a weak white sulphur water.

MCLEAN COUNTY.

No. 2920—MINERAL WATER, from well of B. B. Shacklett, Sacramento, McLean county. Collected by Hon. R. S. Triplett.

Water slightly turbid; very slightly tinted yellowish. Has a somewhat fetid odor in the jug.

One litre of this water, evaporated to dryness at 212° F., left 5.624 grammes of saline matters—(0.562 per cent). This was slightly colored with organic matter, and when heated to redness left some charcoal from the organic matter.

Qualitative analysis showed that the saline ingredients were: Magnesia and lime carbonates with a trace of iron; magnesia

sulphate (the largest ingredient); lime sulphate, and sodium and potassium chlorides.

The presence of organic matters would very probably render this water unsafe as a common beverage, or for medicinal purposes.

MUHLENBERG COUNTY.

No. 2921—COKE, made at the Earlington ovens, Hopkins county, from Coal No. 11, not including 11 inches of the top. Pond river, Muhlenberg county. Coal 6 feet 9 inches thick. Sample collected by R. H. Arkenburgh, Jr. Received May 30, 1888.

No. 2922—COKE, made at Earlington ovens from Coal No. 9, on Pond river. Coal 5 feet 4 inches thick. Collected by R. H. Arkenburgh, Jr. Received May 30, 1888.

COMPOSITION OF THESE COKES.—(Air Dried.)

	No. 2921.	No. 2922.
Hygroscopic moisture	0.30	= 0.20 per cent.
Volatile combustible matters . . . . .	.30	= .30 per cent.
Carbon in the coke	92.60	85.80 per cent.
Ash	6.80	13.70 per cent.
	100.00	100.00 per cent.
Percentage of sulphur	1.896	1.647 per cent.
Color of the ash	} light grey-brown.	} light grey-brown.

No. 2922 contains more than the usual average of ash material. The other coke is quite pure and good.

OHIO COUNTY.

No. 2923—COAL. George Bettamy's mine, near South Panther creek, Ohio county. Bed three feet two inches thick. Sample collected by Moritz Fischer. Received June 27, 1888.

Some portions irregular cuboidal, breaking with shining irregular surfaces; other portions thin lamellated, with thin coatings of mineral charcoal and fine granular pyrites. Some little shining pyrites apparent.

No. 2924—COAL. *Justin Simpson's mine, near Aetnaville, Ohio county, Kentucky. Bed three feet ten inches thick.* Sample collected by Moritz Fischer. Resembles the preceding sample.

COMPOSITION OF THESE OHIO COUNTY COALS.

	AIR DRIED.		CALCULATED DRIED AT 212° F.	
	No. 2923.	No. 2924.	No. 2923.	No. 2924.
Hygroscopic moisture	7.60	10.00		
Volatile combustible matters	37.80	31.40	40.91	34.89
Coke	54.60	58.60	59.09	65.11
Totals	100.00	100.00	100.00	100.00
Total volatile matters	45.40	41.40		
Fixed carbon in the coke	45.00	53.10	48.70	59.00
Ash	9.69	5.50	10.39	6.11
Totals	100.00	100.00		
Character of the coke	spongy.	dense spongy		
Color of the ash	light purplish grey.	nearly white.		
Percentage of sulphur	2.334	0.934	2.527	1.040

No. 2925—IRON ORE. *Land of G. W. Taylor, on west bank of Rough creek, two and a half miles north of Hartford, Ohio county. Sample collected by John R. Procter, August 26, 1888.*

A nodular, dark-blue carbonate ore, superficially oxidized on some parts of the sample. Partially analyzed, the following results were obtained:

AIR DRIED.

Ferric oxide (partly from the ferrous carbonate)	49.360	= 84.55 iron
Alumina	5.713	
Lime carbonate	10.300	
Phosphoric acid	1.867	
Siliceous residue (mostly silica)	14.400	

Magnesia carbonate, carbonic acid, water, etc., were not estimated.

No. 2926—COAL. *Johnson coal, near Fordville, Ohio county. Bed three feet three inches thick. Sample collected by John R. Procter, August 26, 1888.*

Breaks into thin laminae, which are coated, more or less, with mineral charcoal, with some granular pyrites.

No. 2927—COAL. *J. C. Gentry's, three and a half miles south of Fordsville, Ohio county. Collected by John R. Procter, August 25, 1888.*

Breaks, generally, in thin laminae, mostly with irregular, shining surfaces; some covered with fine mineral charcoal. No bright pyrites apparent.

COMPOSITION OF THESE OHIO COUNTY COALS.—(Air Dried.)

	No. 2926.	No. 2927.
Hygroscopic moisture	6.00	6.10
Volatile combustible matters	35.20	40.30
Coke	58.80	53.60
Totals	100.00	100.00
Total volatile matters	41.20	46.40
Fixed carbon in the coke	45.70	49.50
Ash	13.10	4.10
Totals	100.00	100.00
Percentage of sulphur	1.812	2.115
Character of the coke	dense spongy.	dense spongy.
Color of the ash	nearly white.	light greyish-brown.

No. 2927 is a remarkably good semi-cannel or splint coal, which would make good coke, which, however, would contain a rather larger proportion of sulphur. No. 2926 contains a rather large proportion of ash material.

INDEX TO VOLUME A, PART III.

Addenda	149 to 157
Analysis —see Composition.	
Appendix	98 to 135
general remarks applying to	147, 148
Arenaceous clay from Graves county; composition of	42, 43, 146
Ash percentages, comparative, of coals from Bell, Breathitt, Clay, Harlan, Leslie, Perry and Whitley counties	5
percentage, average; of twenty samples of coke from Bell county	6
percentage, average, of four Harlan county cokes	6
percentage, average, of four Knox county cokes	6
percentage, average, of eight West Virginia cokes	6
percentage of West Virginia coals	6
Average ash percentage of twenty samples of coke from Bell county	6
ash percentage of four Harlan county cokes	6
ash percentage of four Knox county cokes	6
ash percentage of eight West Virginia cokes	6
composition of Bell and Harlan county coals compared with that of Connellsville coal	148
composition of Connellsville coal compared with that of nineteen Bell and nineteen Harlan county coals	148
composition of Harlan and Bell county coals compared with that of Connellsville coal	148
Ballard County clays, composition of	13 to 15, 146
composition of mineral waters from	8
composition of soils, subsoils and virgin soils from	9 to 13, 144
glass pot clays, composition of	14, 15, 146
red sandy soil, composition of	11, 12, 144
Bath County , Clinton iron ores, composition of	8, 15; 16, 143
iron ores, composition of	8, 15, 16, 143
Bell and Harlan County coals; average composition of compared with that of Connellsville coal	148
Bell County , ash percentages of coals from, compared with coals from Breathitt, Clay, Harlan, Leslie, Perry and Whitley counties	5
average ash percentage of twenty samples of coke from	6
bituminous coal, composition of	17, 18, 136
cannel coals, composition of	105 to 110, 112, 113, 136, 140, 149, 150
cannel coking coal, composition of	16, 18, 19, 136, 149, 150
coals, composition of	16 to 19, 103 to 113, 136, 140, 149, 150
cokes, composition of	19 to 24, 142
coking cannel coal, composition of	16, 18, 19, 136, 149, 150
limonite iron ore, composition of	113, 114, 143

Bell County semi-bituminous coals, composition of	103, 105, 106, 140
splint coals, composition of	17, 18, 105, 106, 108 to 110, 112, 113, 136, 140, 149, 150
Bituminous coals, composition of	5, 6, 17, 18, 25, 26, 37, 38, 62, 63, 86, 88, 136, 137, 138
coals from Bell county, composition of	17, 18, 136
coals from Breathitt county, composition of	25, 26, 136
coals from Clay county, composition of	37, 38, 136
coals from Knott county, composition of	62, 63, 137
coals from Perry county, composition of	86, 88, 138
or splint coal from Johnson county, composition of	62, 137
sandstones, composition of	150, 151
sandstones from Carter, Grayson and Hardin counties, composition of	150, 151
shales, composition of	6, 47, 49, 50, 65, 66, 137
shale from Clay county, sulphur percentage in	6
shale from Harlan county, composition of	47, 49, 50, 137
shale from Laurel county, composition of	65, 66, 137
Black joint-clay or so-called soapstone, from Calloway county, composition of	34, 35, 146
plastic clay from Calloway county, composition of	34, 35, 146
pyritous plastic clay from Calloway county, composition of	33, 35, 146
Block coals, composition of	5, 55, 57, 91 to 93, 137, 138
coals from Harlan county, composition of	55, 57, 137
coals from Whitley county, composition of	91 to 93, 138
"Blue Lick Water" from Christian county, composition of	151
Blue micaceous clay from McCracken county, composition of	84, 85, 146
Boyle County limestone, composition of	14
Breathitt County , ash percentages of coals from, compared with coals from Bell, Clay, Harlan, Leslie, Perry and Whitley counties	5
bituminous coals, composition of	25, 26, 136
cannel coals, composition of	25 to 27, 136
coals, composition of	24 to 27, 136
splint coals, composition of	24 to 26, 136
Breckinridge County cannel coal, composition of	105
coal (cannel), composition of	150
Butler County mineral water, composition of	27
Caledonia, Illinois , opposite to Ballard county, Ky., composition of green sand from bluff at	15
Caldwell County iron ore (limonite), composition of	151
Calloway County clays, etc., composition of	33 to 36, 146
sands, composition of	32, 33
soils, subsoils and virgin soils, composition of	27 to 32, 144
Cannel coals, composition of	5, 6, 16, 18, 19, 25 to 27, 37, 38, 44, 45, 55, 57, 61 to 63, 65, 66, 69, 70, 86 to 89, 94 to 96, 98, 100, 105 to 110, 112, 113, 117 to 120, 122, 128, 131, 133, 134, 136 to 141, 149, 150, 153, 157

Cannel coals from Bell county, composition of . 16, 18, 19, 105, to 110, 112, 113, 136, 140, 149, 150
 coals from Breathitt county, composition of 25 to 27, 136
 coal from Breckinridge county, composition of 150
 coals from Clay county, composition of 37, 38, 136
 coals from Harlan county, composition of . . 44, 45, 55, 57, 117 to 120, 122, 136, 137, 140, 141
 coal from Johnson county, composition of 61, 62, 137
 coal from Knott county, composition of 62, 63, 137
 coal from Laurel county, composition of 65, 66, 128, 137, 153
 coal from Leslie county, composition of 69 to 71, 138
 coal from Muhlenberg county, composition of 131, 141
 coal from Ohio county, composition of 157
 coal from Perry county, composition of 86, 88, 89, 138
 coal from West Virginia, composition of 98, 100, 139
 coals from Whitley county, composition of . . 94 to 96, 133, 134, 138, 141
 coal from Wise county, West Virginia, composition of 98, 100, 139
 (coking) coal from Bell county, composition of . . 16, 18, 19, 136, 149, 150

Carter County bituminous sandstone, composition of 150, 151

Chalybeate (saline) water from Butler county, composition of 27
 (saline) water from Marion county, composition of 129, 130
 waters from Ballard county, composition of 8
 water from Fleming county, composition of 39, 40

Christian County mineral water, composition of 151

Claiborne County, Tennessee, coals, composition of 134, 135, 141

Clay (arenaceous) from Graves county, composition of 42, 43, 146
 black plastic, from Calloway county, composition of 34, 35, 146
 (black pyritous plastic) from Calloway county, composition of . . 33, 35, 146
 (blue micaceous) from McCracken county, composition of 84, 85, 146

Clay County, ash percentages of coals from — compared with coals from
 Bell, Breathitt, Harlan, Leslie, Perry and Whitley counties 5
 bituminous coals, composition of 37, 38, 136
 cannel coals, composition of 37, 38, 136
 coals, composition of 36 to 39, 136
 splint coal, composition of 37, 38, 136
 sulphur percentage in bituminous shale from 6

Clays, composition of . 7, 13 to 15, 33 to 36, 42, 43, 59, 60, 78, 79, 84, 85, 146
 from Ballard county, composition of 13 to 15, 146
 etc., from Calloway county, composition of 33 to 36, 146
 from Graves county, composition of 42, 43, 146
 from Hickman county, composition of 59, 60, 146
 Clays from Marshall county, composition of 78, 79, 146
 from McCracken county, composition of 84, 85, 146
 (glass pot) from Ballard county, composition of 14, 15, 146
 (gypseous) from McCracken county, composition of 84, 85, 146
 (joint) black, or so-called soapstone from Calloway county, composition of 34, 35, 146